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Mechanix ILLUSTRATED

THE HOW-TO MAGAZINE

FEBRUARY 1980

Pseudo-Oils That Save You Gas

Solar Power From Beneath The Ocean?

Quick & Easy Siding Repairs

Build MI's UrbaSport

It's a Striking Three-Wheeler That Runs on Gas Power or Electric Power

1980 HONDA CIVIC: Tons of Fun With a Social Conscience

ANNUAL BOATING SECTION

- **SPORTY DIESELS:** Boating's New Wave
- **THE JOHNBOAT:** What It Was, What It Is... And What Yours Will Be

3 Classy Cabinets You Can Build *Fast!*

Complete Plans in This Issue

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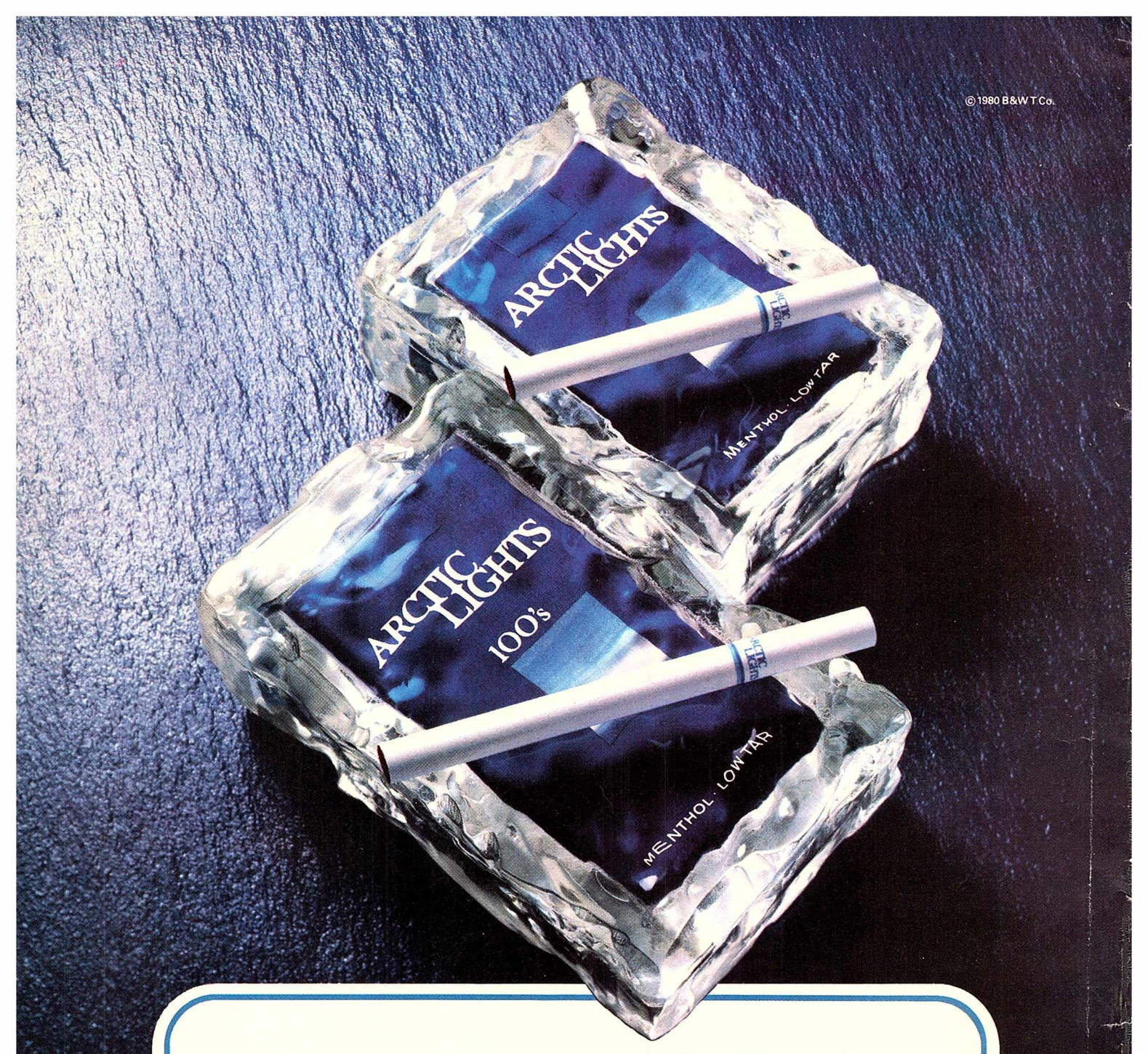

Discover full menthol refreshment without all that 'tar.' Arctic Lights.

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Warning: The Surgeon General Has Determined That Cigarette Smoking Is Dangerous to Your Health.

9 mg. "tar", 0 .8 mg. nicotine av. per cigarette by FTC method.

THE 65 M.P.H. TELEPHONE.

Unlikely as it may seem, a telephone was caught speeding recently in a Miami courtroom.

Even though it didn't appear to be moving at all, a traffic radar gun clocked it at 65 mph.

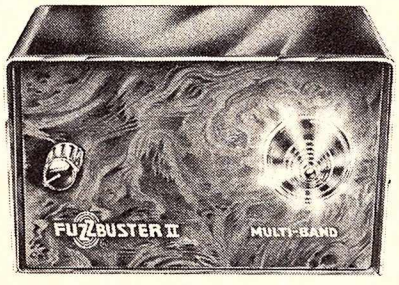
Why was this done? To show the judge that traffic radar can be inaccurate under certain conditions. CB's and other radios, neon signs, even the patrol car's electrical system can distort radar gun readouts. And you can get a speeding ticket you don't really deserve. In fact, according to important new evidence given in a recent Miami case, 25% of traffic radar speeding tickets are in error.

That's why it's a good idea for you to get a Fuzzbuster II Radar Detector.

The Fuzzbuster II can detect all types of traffic radar far enough in advance to allow you to take a quick look at your speedometer and make sure you're in the right when radar's wrong.

Fuzzbuster II has more than twice the effective range of all traffic radar and can pick up radar signals (whether X-band or K-band) over hills, through trees, and around curves.

The Fuzzbuster II Radar Detector. Sometimes even a telephone in Miami needs one.



FUZZBUSTER®
America's number one name in radar detectors.

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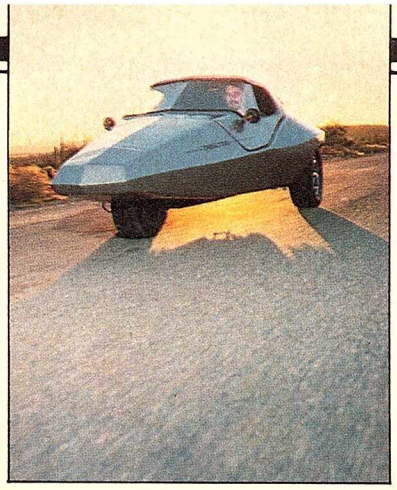

COVER: Homebuilt UrbaSport runs on gas or electricity, gets 60 mpg. P. 31.

OCEAN temperature differences generate 50 kw of electricity. P. 40.

BUILD three cabinets that are distinctive, beautiful, functional. P. 34.

BUILD MI'S MINIHOME!

Smart-looking and easy to build, MI's Minihome atop a VW chassis costs as little as $1,600 to assemble. Do-it-yourselfers can get a complete plans package, including booklet and large-scale plans sheets, for only $15. Send check/money order to Mechanix Illustrated, (a CBS Publication), 32275 Mally Rd., P.O. Box MG, Madison Heights, Mi. 48071. Please ask for Plan No. MI-M-7223F.

Mechanix ILLUSTRATED

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COMING NEXT MONTH
The Cars that are Driving Opec Crazy!
Classic Lap Siding: Easy to do, *Easy* to Afford.
Five Top TV Antennas Rated. In Mar. MI/On Sale Feb. 14.

Best fuel economy of any mid-size wagon.

1980 Ford Fairmont.

Better MPG for 1980.

Fairmont wagon is the right idea for today. Its standard 2.3 liter, 4-cylinder engine has remarkable gas mileage for a wagon.

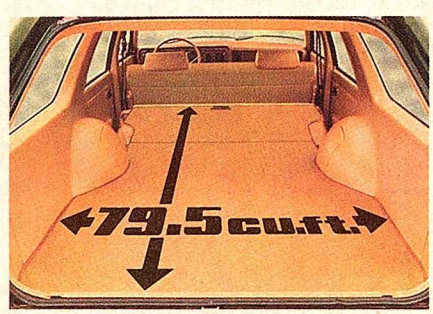
If you're like many wagon buyers and want a 6-cylinder engine, consider this. Fairmont's 6-cylinder has an excellent estimated MPG of 21. No 6-cylinder wagon sold in America—foreign or domestic—beats it.

23	EPA EST. MPG	**38**	EST. HWY. MPG
322	EST. RANGE	**532**	EST. HWY. RANGE

Compare this 4-cyl. est. mpg to other wagons, excluding other Ford Motor Company wagons. Your mpg and range may differ, depending on speed, distance and weather. Actual hwy. mpg and range will probably be less than estimates. Calif. mpg lower. Range based on EPA mpg estimates and Fairmont's 14-gallon fuel tank.

No American-built mid-size has more cargo space.

Fairmont has been engineered for people, to be trim on the outside yet remarkably spacious inside. It's an ideal combination for today's needs. Based on the EPA index, there is 43 cu. ft. of cargo space with the rear seat up and five-passenger seating.



For even more room, fold down the rear seat for 79.5 cu. ft. and almost 7 feet of cargo space. That's versatility.

A standard of wagon value.

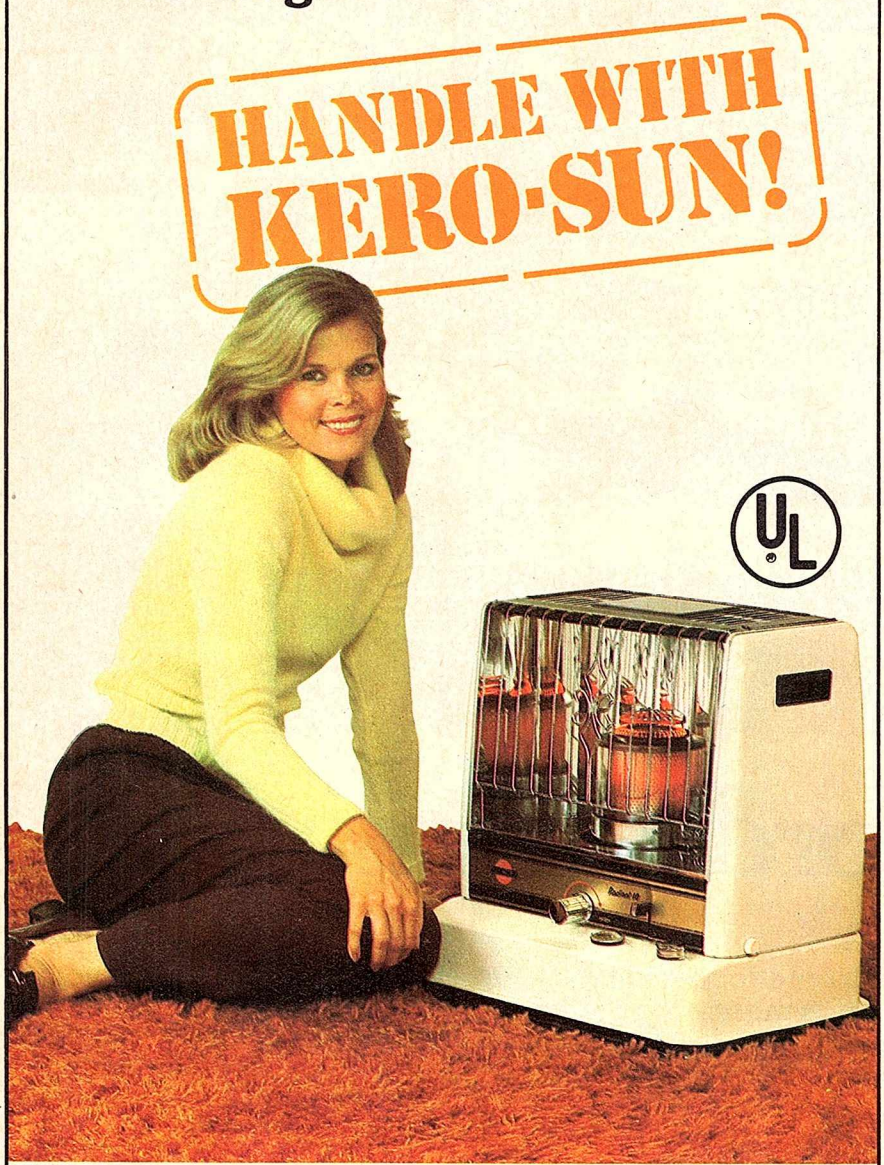
You'll find Fairmont's low sticker price and standard features a pleasant surprise. Choose from a versatile base to the classic Squire Wagon. And be sure to ask your Ford Dealer about the optional Extended Service Plan.

THE RIGHT IDEA FOR TODAY.

FORD FAIRMONT

FORD DIVISION

How to cope with the high cost of heating:



If you're frustrated by the high cost of heating, a Kero-Sun portable kerosene heater gives you low cost heat for only *pennies an hour*. Heats with almost 100% efficiency for 30 hours on less than 2 gallons of clean-burning, safe kerosene. Every Kero-Sun is thoroughly safety-tested. Each has a battery-powered igniter, so you need no matches to light it and each has an automatic shut-off — in case of tip-over. There's *no* smoke, *no* odor, and you need no chimney installation. This may be the winter when a Kero-Sun portable heater is your *only* way to handle the high cost of heating. Write for more information on the whole Kero-Sun line of heaters.

Please send me full facts about Kero-Sun portable heaters and the name of my nearest dealer.

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PORTABLE HEATERS

M-20

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Portable refrigeration price breakthrough! Last chance: $134*

Solid State Refrigeration makes portable coolers as obsolete as grandma's kitchen ice box.

***$25 off-season saving ends with this ad.**

The Koolatron portable keeps over 40 lbs. of food at household refrigeration temperature but weighs only 15 lbs. Only 21" x 16" x 16" ext. Model F1A shown.

The kindest thing you can say about ice boxes is they're better than nothing.

They fall down on the job in hot weather. They look more like swimming pools than refrigerators when the ice melts. And, every other day, you have to dig into your pocket to buy more ice. (If you can find it).

Koolatron's 12 volt portable refrigerators work on thermoelectrics, not ice. And maintain normal refrigeration temperatures.

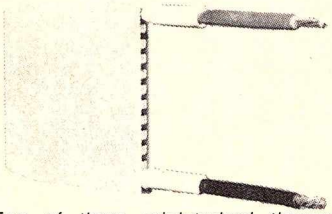
So taking the Koolatron on your trip is like taking a small version of your home refrigerator. Everything — and everybody — stays cool.

USES AEROSPACE REFRIGERATION MODULES

The Koolatron portable cools your food electronically with solid state thermoelectric refrigeration modules. These same powerful modules are used by military and aerospace scientists to cool critical components in rockets and satellites. They use thermoelectric cooling because of its *absolute reliability, insensitivity to motion or level,* small size & weight and minimal battery drain.

WHY IS THE KOOLATRON PORTABLE SO MUCH BETTER THAN AN ICE CHEST?

An ice chest maintains an air temperature of 50-60 deg. F. Meat and milk spoil rapidly at temperatures above 50 deg. F. which is why the top of your meat will go bad even when it is sitting on ice. Koolatron portables maintain normal home refrigeration temperatures of 40-45 deg. F. even in 95 deg. F. weather.



Two of these miniaturized thermoelectric modules replace all the bulky complex piping coils, compressors and motors in conventional portable refrigerators. The modules pump heat from your food into efficient heat sinks where it is dissipated by a quiet fan. They operate on a principal called the "Peltier Effect" — passing electricity through the junction of dissimilar metals causes heat to flow away from the junction.

BOATING, FISHING, CAMPING, HUNTING

Fits into virtually any boat, van or camper. Carry it on the back seat during car trips. Ideal for fishing and hunting — bring your catch back home fresh (a few loads of fish fillets could pay for your portable). Use it for grocery shopping, medicines, carrying film, salesmen's samples. Take it to the drive-in movies, auto races and other sporting events. With an inexpensive battery charger you can use your Koolatron as a bar fridge all winter and a patio fridge in the summer. Run it in your motel room at night and enjoy a midnight snack whenever you feel like it. We have customers using our portables on construction sites, in workboats, laboratories and even in locker rooms for a "cold one" after the game.

THE ULTIMATE PORTABLE REFRIGERATOR

It weighs less than most coolers with a block of ice but holds over 40 lbs. of food or 48 pop cans in its large 36 qt. capacity. Plug it in a lighter socket in your car, boat or van or operate it from a 12 volt battery charger plugged into 110 volts. Cold contents will stay cold overnight with unit off. Draws a maximum of 4 amps., averages about 2 amps. at 70 deg. F. with the thermostat on. Keeps your food cold and dry. Exterior dimensions are 21"L x 16"W x 16"H. Interior dimensions are 16"L x 11-1/2"W x 12"H.

BUILT-IN QUALITY AND DURABILITY

The rugged "ABS" case is filled with the best insulation available — rigid urethane foam. It has a "150 lb. test" handle and non-rusting polypropylene hinge and latches, with stainless steel fasteners. Your portable comes with a 9 ft. detachable cord which plugs into your cigarette lighter. It also has terminals for attaching wires directly from a battery or fuse panel. The same terminals are used for your battery charger clips when operating from a charger. A reverse polarity warning light & buzzer are included. Because of Koolatron's solid state construction your unit should never require any servicing unless physically damaged. If service is ever required, it is available through our service depots in Batavia, NY, or Barrie, Ont., Canada.

GUARANTEE, 21-DAY MONEY-BACK TRIAL PERIOD

Your Koolatron comes with a written 1 year guarantee plus complete instructions and helpful information about batteries and chargers. If for any reason you are not totally satisfied, return it for a prompt refund in full.

PAYS FOR ITSELF

If you are regularly using ice, your Koolatron portable will pay for itself with the money you save on ice, spoiled food, restaurant bills and the gasoline used looking for ice.

SPECIAL OFF-SEASON DISCOUNT!

The Koolatron F1 has regularly been selling at $159. ($179 in Canada.) By ordering off-season you can save a full $25 off these prices. You save! We keep our plant at an efficient operating level off-season! But you must order now.

ADJUSTABLE THERMOSTAT OPTION

For an additional $10.00 you can order the Koolatron portable with an adjustable thermostat in place of the standard fixed temperature thermostat — order Model F1A.

OPTIONAL 110 VOLT ADAPTOR

This custom-made adaptor allows you to operate anywhere on 110 volt power... home, cottage, hotel, patio, pool, ... $29.95 ($34.95 in Canada) plus $3 shipping. Special price if orderd with main unit only $25.00 ($30.00 in Canada). No shipping charges – save $7.95.

Koolatron Industries Limited,
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Phone your order in collect to

705-737-0842

Or use this handy order coupon.

Koolatron INDUSTRIES LIMITED
56 Harvester Ave., Batavia, New York 14020
Canada: 230 Bayview Drive, Barrie, Ontario L4N 4Y8 Dept. 1038

Send me____Koolatron F1 @ $134.00 ($154.00 in Canada) + $7.00 each for handling and delivery in USA or Canada (N.Y., Ont. and Que. residents add sales tax.)

____I want model F1A and have added $10.00.

____ I also want the power adaptor and have added $25.00 ($30.00 in Canada) shipping included. If I order separately it will be $29.95 ($34.95 in Canada) plus $3 for shipping.

I understand that I may return either item undamaged within 21 days and get a full refund if I am not satisfied. I enclose my ☐ cheque ☐ money order for $____ or, please charge my ☐ Visa ☐ Mastercharge ☐ American Express.

Acct. No. _____

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Signature _____
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Name _____

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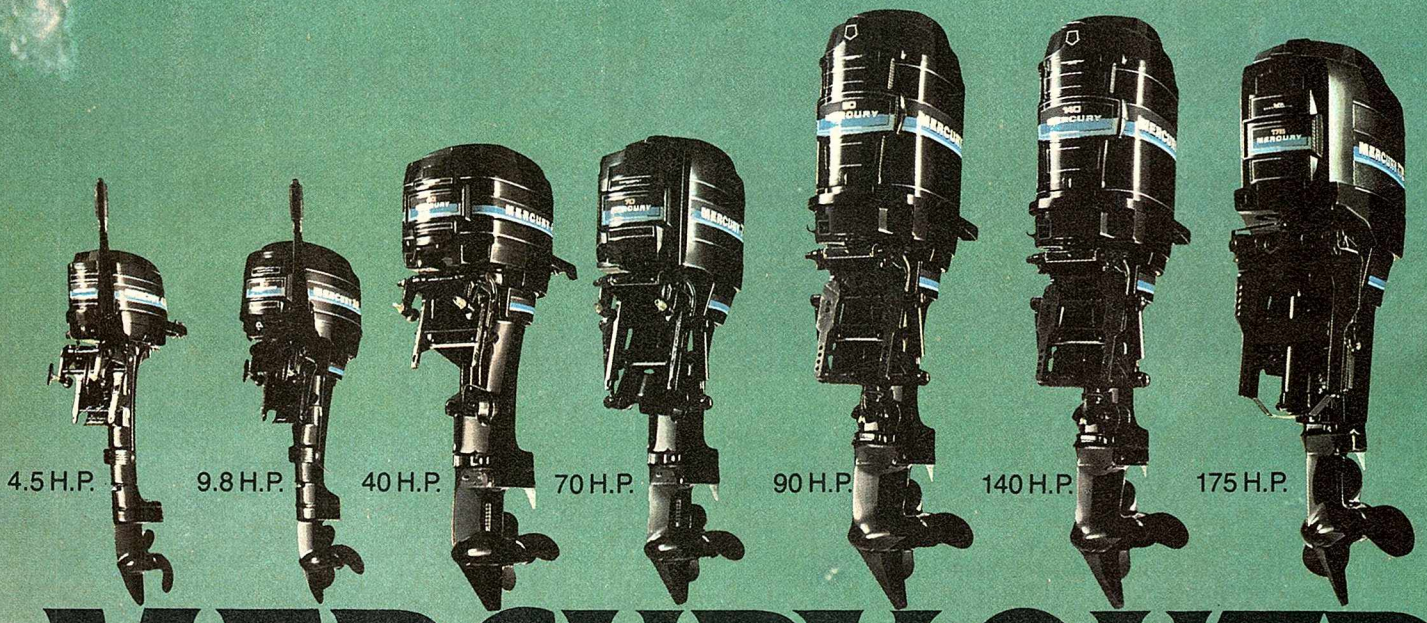

MERCURY OUTB

1980 is the year of the breakthrough for Mercury® outboards. Four new engines, three of them loop charged for better performance and fuel economy. Backed by 40 years of engineering for maximum reliability, and mechanical improvements throughout the line.

New Black Max.®

The new 225-hp Black Max V-6 Mercury delivers more power in a slimmer, lighter, more fuel-efficient design. And to handle all that power, it's engineered with a high-capacity, super-strong bearing system.

New Fishpower.™

The new 3.6-hp, 18-hp and 25-hp Mercs are compact power packages, designed for easy handling. The Merc 18 and Merc 25 are loop charged for better performance and fuel economy. And they're

OARDS FOR 1980

specially engineered for fast and easy servicing — routine maintenance requires no special tools.

Mid-range improvements.

The redesigned 40-hp Merc runs quieter than ever, but with more power and better performance. The 70-hp Merc, too, provides more performance with a new higher rpm range and a new gear ratio.

For fishermen.

Sleek new slimline gearcase design and new prop designs for better weed-shedding. Engines that will troll for hours without fouling the spark plugs — and that includes the high-horsepower Mercs.

Breakthrough in corrosion resistance.

All critical parts are stainless steel or other tough, high-impact corrosion-fighting materials. And a multi-step metal protection process provides an extra-hard corrosion-resistant paint finish. The result — the most corrosion-resistant outboards on the market, in fresh or salt water.

Match your needs exactly.

The 1980 Mercury line — more engines than ever before, and the broadest range of power in our history. Now you can match your needs exactly, for greatest fuel efficiency.

At Mercury, engineering leadership means we never stop making them better. We've given you just a few of the reasons here. Your Mercury dealer will be happy to give you the full story. Visit him soon.

MERCURY OUTBOARDS
A BRUNSWICK COMPANY

Mercury Marine, Fond du Lac, Wisconsin, Canada, Australia, Belgium

Kings, 11 mg. "tar", 1.1 mg. nicotine; 100's, 12 mg. "tar", 1.2 mg. nicotine av. per cigarette by FTC method.

Feel the taste of "Menthol Mist."™

KOOL MILDS
Mild, but not too light.

Now available in 100's.

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Warning: The Surgeon General Has Determined That Cigarette Smoking Is Dangerous to Your Health.

Missives

Address your letters to: Letters Editor, Mechanix Illustrated, 1515 Broadway, New York, N.Y. 10036

• **Calling All Buckle-Up Boosters.** To make a dent in the consciousness of that vast majority of people who don't or won't restrain their children or themselves in a

car, my company has developed a *buckle up or no go* sticker that we're distributing free of charge to the public.

I'd like to send one or more to all of your readers interested in putting this important message on their dashboards. And I particularly am interested in sending as many as necessary to organizations with campaigns promoting child and passenger safety in cars. All they have to do is write to me.

Quentin H. McDonald, Pres.
The Bobby-Mac Co. Inc.
Box 209
Scarsdale, N.Y. 10583

• **Apron Query?** While at a friend's barbecue last summer, I saw the host with one of your MI Grill & Drill Team Aprons and was quite impressed. I'm an occasional reader of MI and would like one of these neat-looking aprons.

Bill Woolner
Phoenix, Ariz.

INQUIRIES

MI will be happy to answer queries from readers concerning articles which have appeared in recent issues.

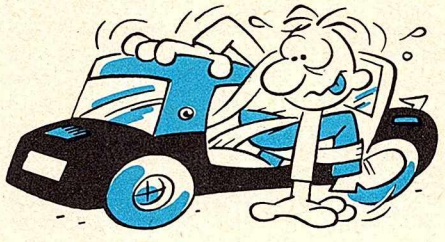
Please mail your questions to us at Mechanix Illustrated Information Dept., 1515 Broadway, New York, N.Y. 10036, along with a stamped, self-addressed envelope.

Just mail $8 (check/money order) to Mechanix Illustrated, a CBS Publication, 32275 Mally Rd., Box MG, Madison Hgts., Mi. 48071.

And why not become a monthly reader while you're at it? For a year's worth—12 big issues—of MI, send $9.94 to Mechanix Illustrated, Box 8162, Greenwich, Conn. 06836. See the handy coupon on this page.

• **Belt Rap I.** I read with amusement the article, Seat Belts You Don't Have to Buckle (Nov. '79). With this contraption, the driver would have to be a contortionist just to get out of his car if he was driving in a locality where it is illegal to exit a car on the traffic side. Perhaps they'll institute alternate side of the street parking: one side for American-made cars, the other for British imports.

Allen M. Rolnick
Brooklyn, N.Y.



Or maybe they'll change the law—which so few obey—and allow for exiting on the traffic side. Careful exiting, that is.

• **Belt Rap II.** After reading the article, Seat Belts You Don't Have to Buckle, I have to say that I would never buy a car with the seat belt connected to the door. If I happened to be in an accident where my door jammed, it would seem that with the seat belt on, I'd never be able to get out. Didn't the auto industry think of this?

Mrs. Sharon Houston
San Lorenzo, Calif.

We inadvertently neglected to mention that there is an emergency safety release contained in the system. Sorry.

• **Oops!** I enjoyed your Nov. '79 issue, especially the article, The New-Car Parade Goes On. I am curious about the descriptions of one of the Caddys and one of the Buicks.

The Caddy Coupe is described as having a 368 V6, which is possible, but I've never heard of such a thing. A V8 would seem better.

Also, the small Buick has a 321 V6 as base, while the bigger Electra only has a 252 V6 as base. Seems kind of strange, doesn't it?

Mark Dahl
Washington Depot, Conn.

The typesetter has made liars of us both. That 368 V6 is all new, all right, and made by Caddy. But it's got two more cylinders—it's a V8. As for the 321 V6, the 2 should be before the 3, not after it. That's a 231 cube V6. ●

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HOT LINE

The World of Science

JOLLY fat men have to be that way. Or so say researchers at Purdue Univ. It seems corpulent people tend to be friendly and outgoing by virtue of high cholesterol levels in their blood. Studies found that if a really chubby person loses a lot of weight, he loses some of his extroverted tendencies, too. In fact, long-term fitness programs can produce a marked personality change because of changes in the body's biochemistry—changes stemming from exercise, that is. Subjects in one test that had shown signs of emotional instability seemed to improve after undergoing a physical fitness regimen, establishing that personality characteristics are in part based on a person's biochemical makeup, claim the researchers.

●

No sooner have those glowing little LEDs and flashy LCDs become standards for displaying numbers on calculators and watches than someone comes up with another type of display that could make them obsolete. Bell Labs has invented a clear film that changes color to blue-black when stimulated by an electric pulse. The film remains colored for hours, though it can be cleared by a pulse of opposite polarity. The beauty of the material, a compound of iridium, is that it uses less power than an LED and does not have to be powered up to remain in display—an advantage over LCDs. What's more, its manufacturing cost can be lower.

●

Time was that astronomers believed the sun was the most stable of stars. Not so. It seems that it's changing in unexpected ways. It's shrinking and slowing down its spin. Also, its magnetic field is fluctuating. Now another traditional belief has been toppled—constant brightness. Scientists at Lawrence Livermore Lab have discovered that the sun's total brightness increases a bit when magnetic regions appear on the solar surface and decreases when sunspots show up. What's more, Sol starts to dim a little just before the appearance of a sunspot, suggesting that a cooling effect rises to the solar surface before the sunspot itself does. By measuring the time difference between these phenomena, the researchers feel they can trace a sunspot's path down to the solar interior, thereby measuring the depth at which it's formed.

●

It's official. You can't see as far as you used to—not in the east, at least. Researchers at Florida State Univ. found that particles formed from sulfur dioxide emissions are reducing visibility in areas of the eastern U.S. It's no secret that around some towns it's hard to see more than a few miles, but now large areas of the countryside are getting just as bad. Sulfur dioxide is emitted by coal-burning power plant stacks and prevailing winds can carry the emissions a long distance. Away from urban areas the SO_2 converts to sulfuric acid aerosol, one characteristic of which is a predominance of particles that scatter visible light. The result: On humid days in the country, visibility is diminished.

●

If all the milk we drink today were sterile acceptable, we could save 12 million barrels of oil a year, says the Univ. of Maryland. What's sterile acceptable milk? It's extract of cow that has been heated sufficiently to kill all bacteria, allowing it to be stored without refrigeration. That gives it a long shelf life, too, without degrading its quality. It's been used in Europe for some time, accounting for 35 percent of the milk produced on the Continent. Energy is saved because milk can be shipped in unrefrigerated trucks, meaning fewer shipments to the grocery, and consumers could buy it in bulk, cutting out unnecessary trips to the market.

●

One of the problems of engaging in aerial warfare is the chance of being hit by groundfire, a problem obviated by flying as close to the ground as possible, cutting down on an aircraft's exposure. The problem with flying low is the airplane could be hit with its own ordnance; that is, a fighter may get caught in blasts from its own bombs. Now a way around that problem is being developed by the Air Force. It's called a lifting body weapon. The device, which can carry bombs or itself be explosive, mounts atop the rear fuselage. With it, the pilot could fly in low, release the lifting body weapon and scat. The gadget would, on its own, climb to its best attack altitude, then release its bombs or dive to the target.

●

A laser to electroplate metal has been developed at IBM. In conventional electroplating methods, an electric field and photographic techniques are combined to make microcircuits for electronics. The IBM technique uses instead a finely focused laser beam to heat up a small surface area on which metallic material is deposited. With the technique, researchers can electroplate regions as small as 4 micrometers (4/25,000) of an inch) in diameter. The new approach could avoid the need for extra steps in the manufacturing process, bringing down costs of mini electronic components.

●

Integrated Pest Management, not increased use of pesticides, could help boost farm yields. In the U.S., total losses in farm products from all pests are nearly one-third of potential production. That means a lot of bugs are eating our food before it gets to grocers' shelves. The Office of Technology Assessment reports that what's needed is more knowledge of the interaction of crop pests and a better system for disseminating information needed to make pest management decisions, among other things. If a way to deal with the problem can be found, the U.S. can cut before-harvest food losses by half, and still reduce the use of pesticides by almost 75 percent, says OTA.

●

Nothing's worse than an epidemic, even if it occurs among lobsters. One type of epidemic for the little crustaceans may be on the way out, however, thanks to a vaccine developed at the Univ. of Maine. The scourge that most plagues lobsters is known as Red Tail, or Gaffkemia, a bacterial disease that invades lobster habitats, often wiping out whole populations. The new vaccine was tried by University scientists on a year's harvest. It helped hold the lobster loss to only 2.5 percent, compared to a loss of 13 percent in prior years. There is no known cure for the disease, but the vaccine could stem its spread to healthy lobsters.—*C.A.M.* ●

Bone Fone™

A new concept in sound technology may revolutionize the way we listen to stereo music.

The Bone Fone surrounds your entire body with a sound almost impossible to imagine.

You're standing in an open field. Suddenly there's music from all directions. Your bones resonate as if you're listening to beautiful stereo music in front of a powerful home stereo system.

But there's no radio in sight and nobody else hears what you do. It's an unbelievable experience that will send chills through your body when you first hear it.

AROUND YOU

And nobody will know you're listening to a stereo. The entire sound system is actually draped around you like a scarf and can be hidden under a jacket or worn over clothes.

The Bone Fone is actually an AM/FM stereo multiplex radio with its speakers located near your ears. When you tune in a stereo station, you get the same stereo separation you'd expect from earphones but without the bulk and inconvenience. And you also get something you won't expect.

INNER EAR BONES

The sound will also resonate through your bones—all the way to the sensitive bones of your inner ear. It's like feeling the vibrations of a powerful stereo system or sitting in the first row listening to a symphony orchestra—it's breathtaking.

Now you can listen to beautiful stereo music everywhere—not just in your living room. Imagine walking your dog to beautiful stereo music or roller skating to a strong disco beat.

You can ride a bicycle or motorcycle, jog and even do headstands—the Bone Fone stays on no matter what the activity. The Bone Fone stereo brings beautiful music and convenience to every indoor and outdoor activity without disturbing those around you and without anything covering your ear.

SKI INVENTION

The Bone Fone was invented by an engineer who liked to ski. Every time he took a long lift ride, he noticed other skiers carrying transistor radios and cassette players and wondered if there was a better way to keep your hands free and listen to stereo music.

So he invented the Bone Fone stereo. When he put it around his neck, he couldn't believe his ears. He was not only hearing the music and stereo separation, but the sound was resonating through his bones giving him the sensation of standing in front of a powerful stereo system.

AWARDED PATENT

The inventor took his invention to a friend who also tried it on. His friend couldn't believe what he heard and at first thought someone was playing a trick on him.

The inventor was awarded a patent for his idea and brought it to JS&A. We took the idea and our engineers produced a very sensitive yet powerful AM/FM multiplex radio called the Bone Fone.

The entire battery-powered system is self-contained and uses four integrated circuits and two ceramic filters for high station selectivity. The Bone Fone weighs only 15 ounces, so when worn over your shoulders, the weight is not even a factor.

BUILT TO TAKE IT

The Bone Fone was built to take abuse. The large 70 millimeter speakers are protected in flexible water and crush resistant cases. The case that houses the radio itself is made of rugged ABS plastic with a special reinforcement system. We knew that the Bone Fone stereo may take a great deal of abuse so we designed it with the quality needed to withstand the worst treatment.

The Bone Fone stereo is covered with a sleeve made of Lycra Spandex—the same material used to make expensive swim suits, so it's easily washable. You simply remove the sleeve, dip it in soapy water, rinse and let the sleeve dry. It's just that easy. The entire system is also protected against damage from moisture and sweat making it ideal for jogging or bicycling.

The sleeve comes in brilliant Bone Fone blue—a color designed especially for the system. An optional set of four sleeves in orange, red, green and black is also available for $10. You can design your own sleeve using the pattern supplied free with the optional kit.

YOUR OWN SPACE

Several people could be in a car, each tuned to his own program or bring the Bone Fone to a ball game for the play by play. Cyclists, joggers, roller skaters, sports fans, golfers, housewives, executives—everybody can find a use for the Bone Fone. It's the perfect gift.

Why not order one on our free trial program and let your entire family try it out? Use it outdoors, while you drive, at ball games or while you golf, jog or walk the dog. But most important—compare the Bone Fone with your expensive home stereo system. Only then will you fully appreciate the major breakthrough this product represents.

GET ONE SOON

To order your Bone Fone, simply send your check or money order for **$69.95** plus $2.50 postage and handling to the address shown below. (Illinois residents add 5% sales tax.) Credit card buyers may call our toll-free number below. Add $10 if you wish to also receive the accessory pack of four additional sleeves.

We'll send you the entire Bone Fone stereo complete with four AA cell batteries, instructions, and 90-day limited warranty including our prompt service-by-mail address.

When you receive your unit, use it for two weeks. Take it with you to work, or wear it in your car. Take walks with it, ride your bicycle or roller skate with it. Let your friends try it out. If after our two-week free trial, you do not feel that the Bone Fone is the incredible stereo experience we've described, return it for a prompt and courteous refund, including your $2.50 postage and handling. You can't lose and you'll be the first to discover the greatest new space-age audio product of the year.

Discover the freedom, enjoyment, and quality of the first major breakthrough in portable entertainment since the transistor radio. Order a Bone Fone stereo at no obligation, today.

*Pending FCC approval.

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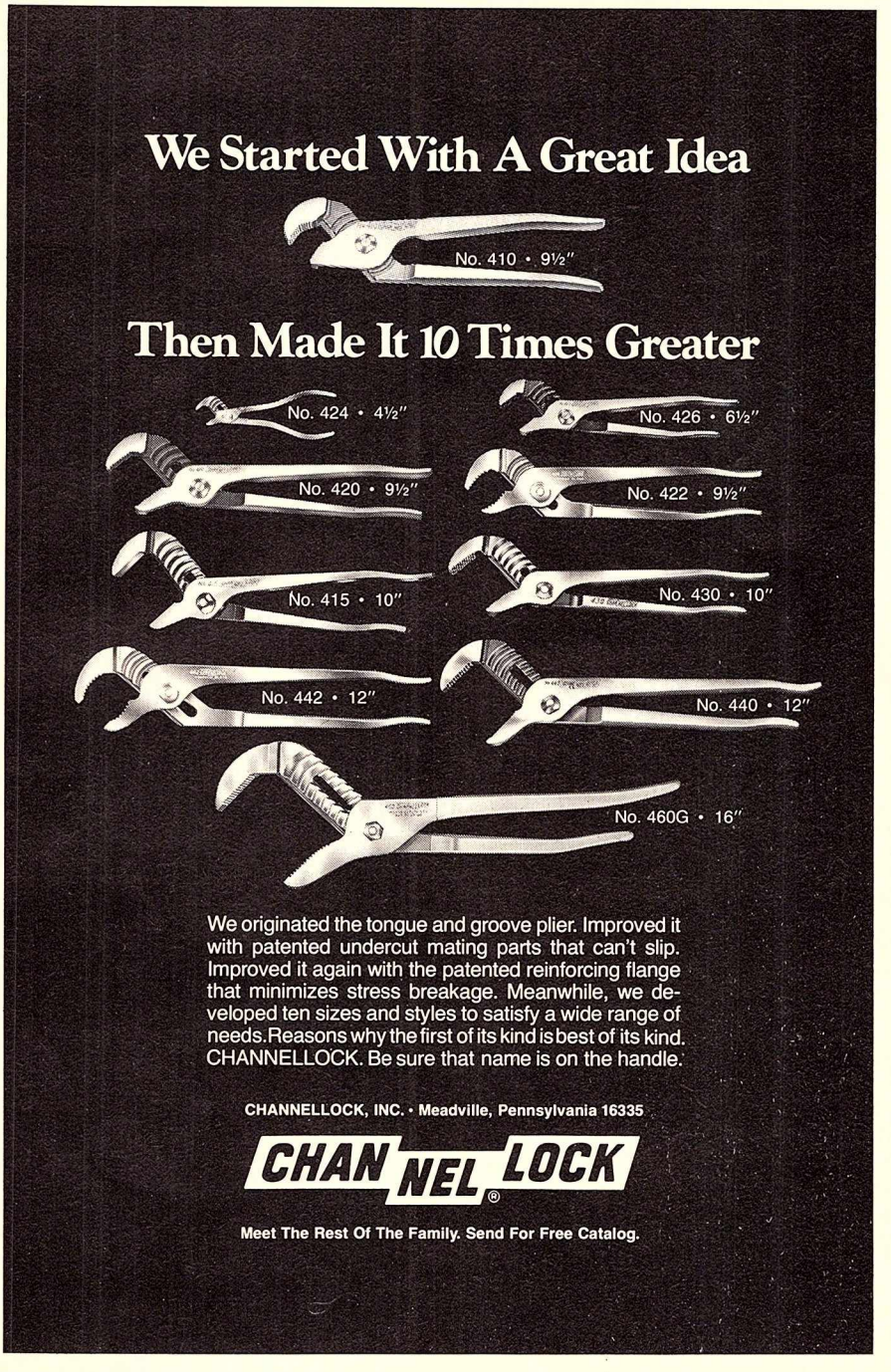
We Started With A Great Idea
No. 410 • 9½"
Then Made It 10 Times Greater
No. 424 • 4½"
No. 426 • 6½"
No. 420 • 9½"
No. 422 • 9½"
No. 415 • 10"
No. 430 • 10"
No. 442 • 12"
No. 440 • 12"
No. 460G • 16"
We originated the tongue and groove plier. Improved it with patented undercut mating parts that can't slip. Improved it again with the patented reinforcing flange that minimizes stress breakage. Meanwhile, we developed ten sizes and styles to satisfy a wide range of needs. Reasons why the first of its kind is best of its kind. CHANNELLOCK. Be sure that name is on the handle.
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SERVICE TIPS FROM DETROIT

DISC brakes tend to squeak, often with no rhyme or reason. Sometimes only when they're cold. Sometimes only when they're hot. Sometimes only when they're wet. Sometimes only when they're dry. But if you have a Chrysler product, specifically one built at the Newark plant, and the brake squeak is prevalent and heard on almost all light-pedal applications, it can be cured. The trick is to swap the standard linings for riveted ones, Part No. 4176778. This should cure it for most rigs, but, alas, not all.

* * *

You can't believe everything you read, even if it's in your car's owner's manual. Manuals for '79 Cadillac Eldorados list the replacement bulb for the instrument panel courtesy lamps as No. 906. That's wrong. It should be No. 89. No. 906 is used in other Caddies—Devilles and Sevilles.

* * *

Those GM X-body cars have electric fans to cool the engine coolant. The plastic fan blade is attached to its motor with a special nut with left-hand threads. To remove the fan blade, turn the attaching nut *clockwise*, or opposite the way you would normally.

* * *

Your Dodge or Plymouth dealer's parts catalog shows two different grommets for the linkage of Omni and Horizon manual transaxles. If the grommet you've got to replace is the one at the forward end of the shift lever, you've got to use the green one, Part No. 3467791. The natural-color grommet, Part No. 5211845, can be used anywhere else in the linkage. When replacing worn linkage grommets, carefully clean the hole in the linkage of burrs and nicks without enlarging the hole. And use grease to help install the new grommet and add to its life.

* * *

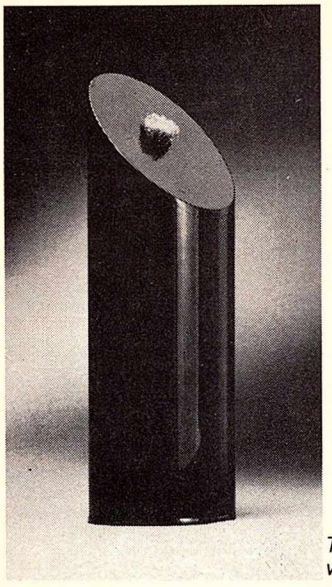
There are some Westmoreland-built VW Rabbits with engine-coolant temperature gauges mated to sending switches meant for temp warning lights. The switch, Part No. 861 919 521 isn't meant for use with the gauge and a wrong reading is the result.

* * *

Noisy heater controls on some Saab 900s is due to the heater inlet hose, the one to the lower connection on the heater valve. That hose is clamped to the alternator to prevent its wearing through by rubbing on the alternator. Removing the clamp reduces the vibrations and noise that the hose picks up and transmits. To save the hose from rubbing through, then, install a protective sleeve over it at the alternator, instead of the clamp. Saab sells a sleeve, Part No. 93 30 838. Or you can make one out of a piece of rubber hose with an inside diameter of 1¼ in. and about 7 in. long.

* * *

Some '79 Cordobas, Magnums and Dodge and Plymouth vans that were built in Canada have funny-looking automatic transmission fluid. This fluid looks more like engine oil than the usual red stuff. Don't worry. Despite its color it works just fine and is perfectly compatible with Dexron type fluids.—*D.C.* ●



Miracle Fuzz

A new space-age invention and the same effect as lightning combine to create the world's first home oxygen regeneration system.

The new Energaire ionized oxygen generator will make a handsome addition to any desk.

You need oxygen to live. You can live without food for 60 days, without water for seven days, but without oxygen, you won't make it past two minutes.

That small piece of fuzz located on top of the cylinder shown above emits negatively-charged electrons which attach themselves to molecules of oxygen, thus creating ionized oxygen.

You are already familiar with ionized oxygen if you've smelled the air after a thunderstorm. You feel great, revitalized, and alert. The lightning from the storm adds a small negatively-charged electron to each oxygen molecule in a process called ionization.

SCIENTISTS DISCOVER

Scientists discovered that air quality can actually affect your moods, your feelings and your sense of well being. Air that is positively charged caused people to be depressed, moody and tired. Negatively-charged air made people feel good. We have all experienced air that is positively charged in air-conditioned buildings or in a polluted environment.

Scientists looking for a way to turn positively charged air into negatively charged air developed the negative ion generator–a product that produces negatively charged particles that attach themselves to air molecules and thus create the same fresh feeling you get after a thunderstorm.

The new space-age product shown above is an ionized oxygen generator called the Energaire air purifier. The copper mesh fuzz on top of the unit is one of the secrets of the system.

Although it has no moving parts, you can actually feel a wind of ionized oxygen produced from the fuzz which spreads to fill an average-sized room in one minute.

CIGARETTE SMOKE TEST

To show the dramatic effect of ionized oxygen, you can take the Energaire, blow cigarette smoke into a clear bowl, and hold the bowl inverted over the system. The smoke will vanish. The charged oxygen particles appear to dissolve the smoke particles, precipitating them from the air.

In a room, the Energaire air purifier surrounds you with these oxygen ions and cleans and purifies the air so that even in a smoke-filled room, you will be breathing cleaner, country-fresh air all day long.

WALL TEST

Take our unit and place it next to a wall. Also put a large piece of paper on the wall. Within a few days notice how black the paper gets. That black film is finite carbon particulate matter–the same pollutants you would normally breathe and that would pass through most air filters. By placing the unit in the center of a room or away from a wall, that same matter falls to the ground as dust.

A trip into the mountains exposes you to nature's freshly ionized oxygen. The Energaire produces this same effect. It will clean your room of odor-causing bacteria and stale, musty, or smoky air.

Ionized oxygen should not be confused with ozone. Ozone has a molecular formula of O_3, whereas the molecular formula for ionized oxygen is O_2 with a negatively-charged ion.

DON'T BE CONFUSED

After we announced the Energaire last year, many companies came out with their own ion generators. We purchased a unit from each company and tested them at an independent laboratory. The results are shown below:

Name	*Ions	Price
Energaire	438,000	$79.95
Omega 700	63,000	245.00
AirCare	72,000	149.95
Modulion	75,000	79.95
EnvironAire	-0-	119.50

The one unit mentioned above that produced no ions actually produced ozone–15 times the maximum ozone concentration allowed by federal government standards.

**Measurements indicate total number of ions per cubic centimeter per second at one meter. These figures may vary by plus or minus 10%.*

USED IN HOSPITALS

Many hospitals are now using ionized oxygen systems in their operating rooms and burn centers. Their units not only purify the air, but they also eliminate pollen and other irritants.

Working in a clean air environment, you think clearer, are more alert, and you function better. The Energaire is actually a miniature lightning machine. The minute you plug it in, energy is converted into ionized oxygen. This efficient system uses one watt of power or less than a penny per day to operate, so you leave it plugged in continuously.

We are so impressed with the pleasant effect of Energaire that we urge you to personally test it yourself in your home or office. Order one at no obligation. Put it by your desk, or in any room where you spend a great deal of time. See if it doesn't rid your room of odor-causing bacteria and stale, musty or smoky air. Try the smoke and paper tests mentioned in this advertisement.

SLEEP FASTER

At home, use the Energaire by your bed and see how country-fresh air allows you to sleep easier, deeper, and more relaxed.

You should notice the difference within one day–especially in a work environment. But use the Energaire for a full month. Then, if you do not feel totally convinced of the positive effects of ionized oxygen, return your unit for a prompt and courteous refund.

The Energaire is manufactured by the Ion Foundation, a leading ion research and development company.

Service should never be required, but if it is, there's a prompt service-by-mail center as close as your mailbox. JS&A is America's largest single source of space-age products–further assurance that your modest investment is well protected. The Energaire measures 9" high by 3" in diameter and weighs 24 ounces.

To order your Energaire ionized oxygen generator, send **$79.95** plus $3.00 for postage and handling (Illinois residents, please add 5% sales tax) to the address shown below or credit card buyers may call our toll-free number below. We will send your Energaire ion generator complete with 90-day limited warranty on the electronics, a five-year warranty on the fuzz, and complete instructions.

Let space-age technology revitalize your life with the world's first home ionized oxygen generator. Order one at no obligation today.

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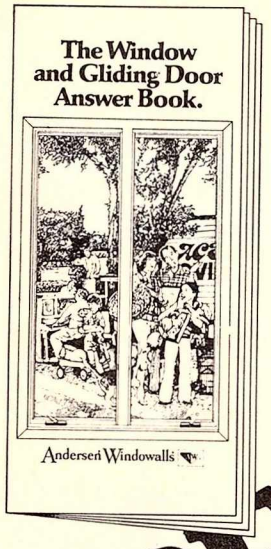

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HOME & SHOP

By Burt Murphy

A Handle on Heat

WARMTH when and where you want it has got to be a dream come true—especially after more than half a winter in a chilly woodworking shop or during those late hours when the thermostat is down and an old Bogart flick is up for viewing.

My one mad raving throughout winter '79-'80 was to clap onto some kind of portable thing that would sustain life with heat beyond the centrally heated zone or after hours.

Deliverance came late, but was no less welcome, in the form of a little space heater that looks like an overgrown camp lantern. What really grabbed my attention was the manufacturer's claim: 9,000 BTUs per hour output. To clinch it, the little bugger was said to go for 18 hours on less than one gallon of fuel.

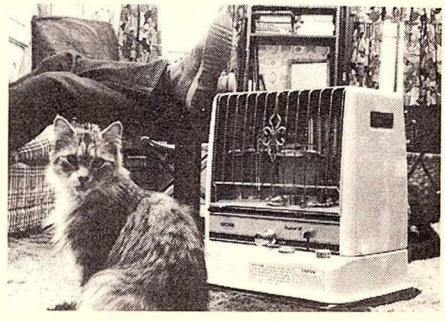
Okay, I thought, let's try it. Queries to the manufacturer turned up a complete line of similar heaters with varying outputs —and more devilishly interesting performance claims. I wound up with two more heaters: a 9,400-BTU-per-hour radiant model said to burn over 30 hours on less than two gallons and a big-daddy 18,000-BTU-per-hour model rated for 18 hours of performance on two gallons.

Other claims also piqued my interest. They are fueled by kerosene. My first reaction was to pass, having spent more than enough time in military housing with central kerosene heaters—and the smells, spills and ever-present dangers. No, said the makers, our heaters are odorless, safe and silent. All I had to do was bask in their warmth.

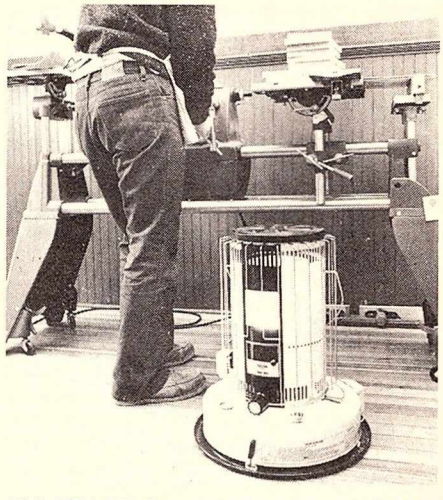
And so I did. The line is known as Kero-Sun, they are made in Japan and the basic design features—right down to a handle for lugging from room to room—are extremely well thought out.

Common to all is a safety fea-

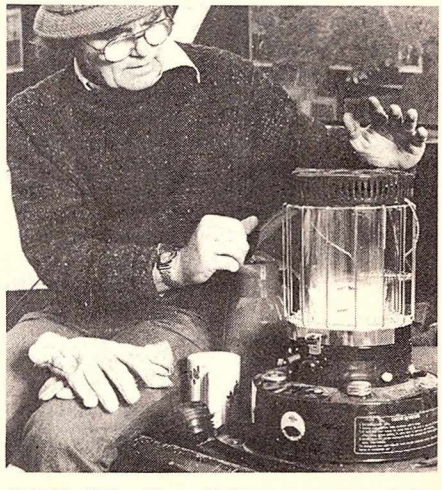
(Continued on page 141)



CONCAVE stainless-steel mirror on Radiant 10 reflects heat out, register on top lets heat go up. Burns 30 hrs. on about 2 gals.

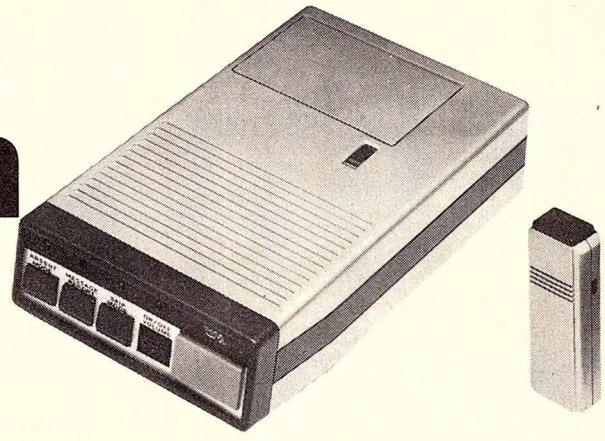


BIG-STACK Omni 105 puts out 18,000 BTUs, goes for 18 hrs. on 2 gals. of kerosene. Omni easily heated my large shop.



CUTE little Moonlighter was great for warming the hands while outdoors. A 9,000-BTU stack-type, it goes for 18 hrs. on 1 gal.

Friendly Comparison



Can JS&A offer a better telephone answering unit than the first one we introduced? Here's the story of American competition at its finest.

We've seen them all. Every telephone answering unit has its advantages and disadvantages.

So when JS&A selected our first telephone answering unit three years ago and called it the best remote system available, it soon became one of the most popular units on the market. Since 1976, JS&A has sold thousands of them.

SERIOUS COMPETITION

But that was three years ago. It finally took an enterprising company called Olympia to develop and introduce what we would call the first serious competition to our first telephone answerer.

So JS&A had a dilemma. Here we were, with an excellent relationship with a major supplier, and yet our reputation demands that we offer our customers only the most advanced products. Do we continue to carry both units, or do we break off relations completely and introduce a competitive model? To make the decision more difficult, you first have to understand the new technology in the Olympia unit.

A FAIR COMPARISON

The Olympia Master Telephone Recorder is a microprocessor-based system with a few features that make it a more advanced unit than the industry leader.

But to provide a fair comparison, there are a few disadvantages with the Olympia. The Olympia does not have a call counter that tells you at a glance how many calls you've received. And its outgoing announcement is not recorded as fast as with our first unit. But there are so many other features and advanced technology that the Olympia deserves your consideration.

ERASE OR SAVE

Most remote units and the Olympia have remote pagers. When you want to retrieve your messages, simply hold the pager up to the telephone, press a button, and the telephone answering unit rewinds to the start of your first message and plays them back.

That's great. But there was a disadvantage to the others. After you listened to your messages, you could not rewind. If you wanted to rewind to the beginning of the tape, you had to call your unit a second time. That's only a slight problem if you're calling locally from a phone booth, but very costly when you're calling long distance. And if you don't call back right away and rewind, you have another problem. Later, you'll have to listen to all those messages you previously heard because the unit doesn't know where the old messages stop and the new ones start.

The new Olympia Master Recorder has solved that problem. You have a choice. You can either hang up after you've heard your messages or you can rewind them to the beginning while you're on the phone.

NO MESSAGE/LAST MESSAGE

Let's say you call in and there are no messages for you. The Olympia has a special beep tone that tells you the moment you call in that there is no message. Or let's say there are three messages waiting for you. After the three messages are played back, another beep tone signals you that you've finished your last message. There is no provision like this on any of the popularly priced units.

YOUR OWN TAPE

The Olympia uses one commercially available cassette tape that will last a few years with normal use. Today's most popular unit uses a built-in tape that will last five years, and costs $17 to replace. With the Olympia unit, you remove the old cassette and pop in the new one which shouldn't cost more than $2.

TAPE SPEED

It costs time and money to listen to your old messages and to rewind. So the Olympia not only improved the concept by giving you a choice, they also improved the tape rewind speed. Now, when you retrieve your calls, your rewind time is faster than many other systems and as fast as the system we formerly sold.

Not only is the Olympia faster, but it measures only 2¼"x 6"x 10" and weighs only 36 ounces. You can place your phone on top of the unit or next to it without cluttering your desk.

We could probably present reasons why the Olympia Master Recorder will pay for itself with just the time you save retrieving messages—but there's more.

SINGLE SYSTEM

You record your outgoing announcement on one track of the cassette tape and you receive your incoming messages on the other side. This single cassette approach reduced the costs of the Olympia below those of the conventional recorders that required two separate record and playback systems. And like other units, when you play back your tape, you hear only your incoming messages—never the outgoing announcement.

To record an outgoing announcement, you simply press the record button and talk into a microphone supplied with the unit. The unit will record a 17 second outgoing announcement and a 30 second incoming message. Our previous unit records a 20 second outgoing announcement and a 30 second incoming message.

AND THEN THERE'S VALUE

Our previous unit sold for $269.95. The Olympia sells for only $169.95—a $100 savings before you even start to use the system.

But don't take our word for it. Order an Olympia from us on our 30-day telephone answering test. Personally see how quickly you can retrieve or rewind your messages without having to call in twice. See how this compact unit fits on your desk. And above all, note the quality and workmanship of this fine piece of equipment.

Then after 30 days of messages, decide if you want to keep your unit. If not, no problem. Just return your unit for a prompt and courteous refund including your $3.50 postage and handling.

If you decide to keep it, great. You'll own the most advanced unit of its kind. The Olympia Master Recorder is sold exclusivly by JS&A. We're America's largest single source of space-age products, and we have sold more telephone answering units than many of our competitors combined. We know the market.

MULTI-NATIONAL CORPORATION

Olympia is a multi-national corporation with eight national factory service and service-by-mail facilities—further assurance that your modest investment is well protected.

To order your Olympia, send a check for **$169.95** plus $3.50 postage and handling made payable to JS&A Group, Inc. (Illinois residents add 5% sales tax.) Credit card buyers may call our toll-free number below. We'll send your unit complete with recording microphone, one cassette tape, remote pager, AC adapter, instructions, and a 90-day limited warranty—everything you'll need for your 30-day test.

When we realized that the Olympia was the unit we should market, we called our previous supplier and told them of our decision.

In today's changing times, technology does not stand still. Despite our excellent relationship with our previous supplier, we felt it our obligation to introduce today's most advanced products—even at the risk of losing a valuable supplier.

If you're considering a new telephone answering unit, we can't recommend a better system than the Olympia Master Recorder. Why not order one at no obligation today?

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How to get rich

START YOUR OWN BUSINESS RIGHT FROM YOUR HOME— AND MAKE A FORTUNE IN MAIL ORDER!

Mail Order Beginners Get Cash by Mail!

Have you ever thought of operating a little mail order business of your own? Something you could start on a shoestring right from home in your spare time. It's a fabulous business!

Bob Carter of Newark, N.J. ran his first small mail order ad in House Beautiful magazine — offering an auto clothes rack. Business Week reported that his ad brought in $5,000 in orders. By the end of his first year in Mail Order, he had grossed over $100,000!

Another beginner — a lawyer from the midwest, sold a mail order item to fishermen. Specialty Salesman magazine reveals, "he made $70,000 the first three months!"

There is no other business where you can make a fortune so fast. Come up with a 'hot' new item . . . and WHAM!

It strikes like a bolt of lightning!

Millions of people read your ad and suddenly, you are swamped with cash orders from all over the country . . . MORE MONEY in 60 days than you could earn in a lifetime!

Like the Vermont dealer who ran one ad in Sports Afield magazine. His ad pulled 22,000 orders — over A HALF MILLION DOLLARS IN CASH!

Yes, Mail Order is the fastest-growing, most profitable business in America! And now with the population explosion . . . the huge teenage market . . . and more people moving to the suburbs — we are on the verge of the BIGGEST BOOM in Mail Order history!

Free

If you are sincerely interested in starting a lucrative business of your own ACT NOW! We can help you get rich in Mail Order just as we've helped others. Mail the coupon or send a postcard. We'll send you a free book, catalog, ads and complete facts about our offer. No salesman will call. No obligation. You don't need previous experience but you must be over 21. Write to:

Mail Order Associates, Inc., Dept. 213
Montvale, New Jersey 07645

Mail Order Associates, Inc., Dept. 213
120 Chestnut Ridge Rd.
Montvale, New Jersey 07645

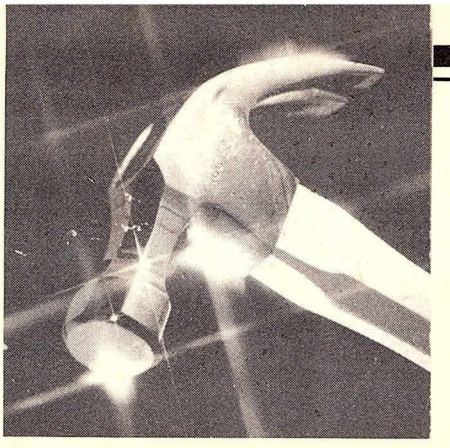
Please rush full details immediately.

Name_____

Address_____

City_____

State_____ Zip_____



GOLDEN HAMMER

Win a full-size gold-plated Hammer or Tie Bar or a Certificate of Merit. Send a crisp black-and-white photo of your project to MI's Golden Hammer Awards, 1515 Broadway, New York, N.Y. 10036. Include negative, a brief description and also a stamped return envelope.

GOLDEN HAMMER AWARD WINNER

GAZEBO in the park was built by Dr. Richard A. Young, a general practitioner in Clarion, Iowa. It's a copy of a gazebo bandshell that stood on the same spot in the late 1800s. Dr. Young set about building a replacement for the town, working from a picture postcard of the original.

A few years earlier, Dr. Young built a woodworking shop in his backyard; he's been working on small projects ever since. The gazebo, however, was by far his most ambitious undertaking. The eight-sided gazebo is built of treated lumber and has cedar shingles. It's wired and lighted for band concerts and other performances in the park.

Once word got out about what Dr. Young was building, contributions totaling nearly $5,000 poured in from individuals, organizations and businesses in Clarion and the surrounding area.

The bandstand was dedicated last June with speeches, bands, singers, a pig roast, a box social and dancing. Dr. Young's project was submitted by one of his many friends. ●

TIE BAR WINNERS

- Lewis Pizzarelli, Poughkeepsie, N.Y.
- Olaf M. Staff, Osage, Iowa
- Harold E. Peterson, New Britain, Conn.
- W. H. Milton, Marianna, Fla.
- Wally Sidor, Fresno, Calif.
- W. A. Thompson, Lindsay, Calif.
- Jack W. Boberg, Cypress, Calif.
- Herbert C. Berg, San Carlos, Calif.
- Ivan E. Wolf, Dubuque, Iowa
- Warren F. Willis, FPO San Francisco
- Thaddeus R. Kuyda, Ann Arbor, Mich.
- Frank J. Hutnk, Windsor, Ont.

CERTIFICATES OF MERIT

Clarence Crew, Carrollton, Ga. ● Ray McInerney, Saginaw, Mich. ● Fred Klatt, Houston, Tex. ● Norris Jacobson, Fertile, Minn. ● Dan Hopson, Houston, Tex. ● Eddie Dunn, Arcadia, Tex. ● Donald T. Wells, Collinsville, Ill. ● Paul Hurmpartzian, Brantford, Ont. ● T. J. Pehoski, North St. Paul, Minn. ● Robert Adams, Denfield, Ont. John Bossler, Belleville, Ill. ● Vernie Read, Paradise, Calif. ● Melvin G. Ross, Galesburg, Ill. ● Richard C. Anderson, Hollywood, Fla. ●

The chances are excellent that...

You have a talent other people are willing to pay for!

You're "handy" around your house, have the ability to fix things, and "make them work right"... that's why there may be a rewarding career for you in Electronics.

A career in Electronics?

Absolutely. Because you're interested in *things*. How they work. Why they work. How to take them apart and put them back together. Plus . . . you've got a head for detail work.

Your chances are excellent

With the right kind of *specialized* technical training, you can have a challenging, financially rewarding future waiting for you in Electronics. Think of the career opportunities . . computers, aerospace, 2-way radio communications, radio/TV broadcasting, medical electronics, to name just a few.

And, surprisingly, you don't need a college degree! All you need to do to qualify for one of these exciting career fields is to build upon the technical aptitude you already have . . . just put your hands and your head to work with a CIE Electronics career course.

You learn by doing

The CIE method of instruction is the refinement of over 40 years of Electronics, independent home-study experience. It works. And you don't need *any* prior Electronics experience. A CIE *career* course can take you from ground zero right up to training in Lasers, Microminiaturization, Radar, Analog Computers, various applications in Communications.

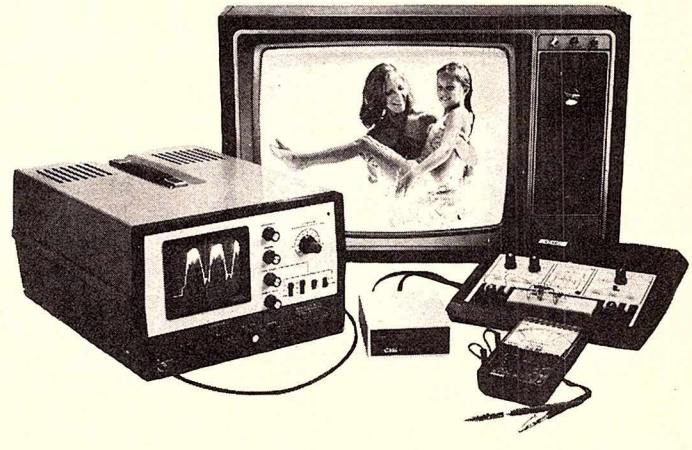
In some CIE courses, you'll perform "hands-on" experiments and tests with your own CIE Personal Training Laboratory. And, if TV technology and digital Electronics are your main interest, you can select from several courses that involve working with and troubleshooting a TV. (And the TV is yours to keep, too!) This combination of "head and hands" learning *locks in* your understanding of the crucial principles you'll use on the job in your new career. But, don't kid yourself . . .

Electronics is not an "easy" science and CIE courses are not "snaps." Subject matter is technical, thorough, and challenging. It has to be. We're training you for a *career*. So the presentation of ideas is logical, written in easy-to-understand language . . . you progress step by step, at your own pace.

CIE Education by mail

There is no need to "go back to the classroom" with CIE. Because you learn at *home* or wherever else is convenient. You keep your present job and income. No cross-town commutes. *You* decide when and where *you* study best.

Your eventual success . . . at CIE and in your electronics career . . . will be determined by your own motivation and self-discipline. You *can* do it. And CIE can show you how.



Patterns shown on TV and oscilloscope screens are simulated.

Put your talent to full use

We believe that you may be a "natural" for Electronics, and we'd like to tell you more about potential career fields and our school. We'll be glad to send you our complete package of FREE career information if you'll send in the card or write mentioning the name and date of this magazine. For your convenience, we'll try to have a school representative contact you to review various educational programs and assist in course selection. As soon as we receive your request, we'll mail you our school catalog, complete G.I. Bill details, and special information on government FCC License preparation. There's no obligation.

Let's discuss your new career in Electronics, NOW! Send for your FREE school catalog and career information TODAY.

CIE **Cleveland Institute of Electronics, Inc.**
1776 East 17th Street, Cleveland, Ohio 44114
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Hard-to-please smokers amazed by volume of taste in Golden Lights. 8 out of 10 switching from higher tar brands...for good.

Warning: The Surgeon General Has Determined That Cigarette Smoking Is Dangerous to Your Health.

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Low Tar & Nicotine · Satisfying Taste · by Kent.
8 Mg Tar. 0.7 Mg. Nicotine
Golden Lights Deluxe 100s
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8 Mg Tar. 0.7 Mg. Nicotine
Golden Lights Menthol 100s
Menthol 100s
Golden Lights Menthol
Menthol

20 MG. TAR 1.3 MG. NIC.

17 MG. TAR 1.0 MG. NIC.

17 MG. TAR 1.4 MG. NIC.

16 MG. TAR 1.1 MG. NIC.

16 MG. TAR 1.1 MG. NIC.

16 MG. TAR 1.0 MG. NIC.

19 MG. TAR 1.3 MG. NIC.

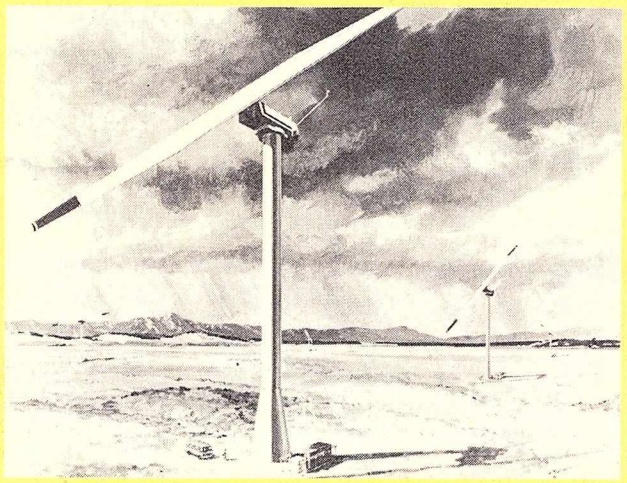
8 MG. TAR 0.7 MG. NIC.

Golden Lights.
The taste high tar smokers want in a low tar.

Source comparative 'tar' and nicotine figures: FTC Report May 1978. **Of All Brands Sold:** Lowest tar: 0.5 mg.'tar,' 0.05 mg. nicotine av. per cigarette. **Golden Lights:** 8 mg.'tar,' 0.7 mg. nicotine av. per cigarette by FTC Method.

THE ENERGY LINE

THE FIRST cluster of giant wind turbines is planned for the state of Washington. On a site in the Goodnoe Hills, the federal government is planning to build three of the world's largest (300-foot) wind turbines, each of which will put out 2.5 megawatts. Together, the power output of the three will be enough to run 2,000 to 3,000 average homes. The turbines are to go into operation by the middle of next year with power from them fed into the local Bonneville Power Administration's grid. One of the unique features of the project is the fact that the wind turbines will supplement hydroelectric power prevalent in the area (two indirect uses of solar energy). The turbines are designed to be prototype devices that could eventually be built by others in the commerical power industry. If mass-produced, the cost of each giant could be held to about $2 million, which makes them competitive with existing sources of energy. The turbines will be the world's most powerful to date.

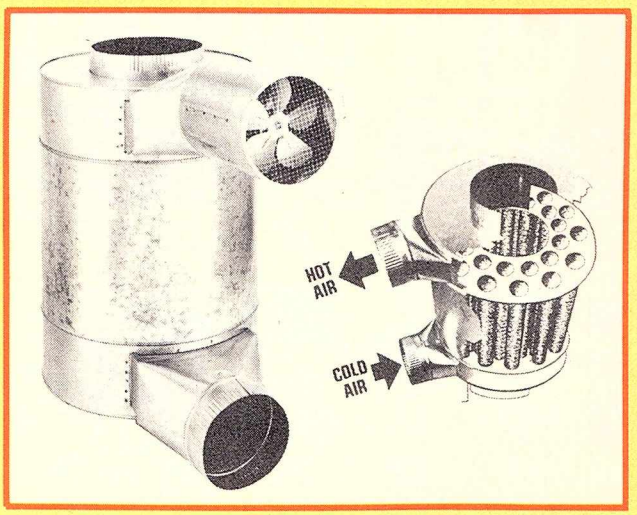


Geothermal Spirits

One of the problems of using alcohol as a substitute or supplement for gasoline is the fact that it takes energy, often in the form of fossil fuels, to make the stuff. The manufacturing process is not remarkably energy-efficient, to the point of canceling out the gains from grains. But now a new method of making alcohol could be in the offing —using geothermal power to distill it. At the DOE's Raft River geothermal site in Idaho, researchers are experimenting with natural hot water, using its heat to distill sugar beet syrup into alcohol. The researchers plan to check out other materials from which alcohol can be distilled—including wheat straw and pine chips.

Hot Water Maps

Heat pumps are, no denying it, a boon to the energy-conscious. But few of them do much good if the temperature outside dips to really cold levels. One natural source of heat that can be utilized to assist heat pumps, however, is right below our feet: underground water. The U.S. Geological Survey is helping to map areas of the country where heat pumps could be used to collect heat from underground water, concentrate it and distribute it to buildings near developed sites. Surveys began out West and already more than 1,000 warm-water wells or springs have shown up in each state surveyed. Maps are available to the public.



Reclaiming Monster

A really big-capacity heat reclaimer, capable of capturing 57,000 BTUs of heat that would ordinarily fly up the chimney, comes from Gateway. The gadget, Model 444A, can work with oil, gas, coal or wood furnaces. It consists of 24 aluminized carbon steel heat transfer tubes and a fan to force air over them. The heated air flows into a vent which can be ducted to another room. A thermostat turns the fan off should stack temperatures fall below the minimum necessary for operation of the heating appliance. The unit is 24 inches tall and 16 inches in diameter. It's made in sizes to fit 6-, 7- and 8-inch flues and is listed by Underwriters' Lab.—*C.A.M.*

IMPORTED CANADIAN WHISKY · A BLEND · 80 PROOF · CALVERT DIST. CO., N.Y.C.

Right to the finish, its Canadian spirit stands out from the ordinary. What keeps the flavor coming? Super lightness. Superb taste. If that's where you'd like to head, set your course for Lord Calvert Canadian.

The unique spirit of Canada: We bottled it.

The Fish That Took Over Winter

ROCKY MOUNTAIN winters are hard and long, and cabin fever would reach epidemic proportions among anglers were it not for a sporty little rascal known as the whitefish.

Different species of whitefish are found throughout the United States, generally in the same kind of environment that supports trout. In the East and Upper Midwest, Lake and Menominee whitefish prevail, and the Western variety is known as the Mountain whitefish. Only in the West, however, is whitefishing elevated to major sport.

Although fly fishermen tend to cuss them in warmer months (because they usually beat trout to a hook), several whitefish traits qualify them as a winter blessing—they feed all winter long, their flesh is superb when they're caught in cold water and there are plenty of them.

A typical whitefishing day begins with a bright sun or moderating temperatures brought on by a Chinook wind. Some folks fish when the temperature hovers near zero. Indeed, whitefish bite then, too. But such bitter cold creates complications such as iced guides, frozen reels and bait so hard that you can't pierce it with a hook. There's also the matter of personal comfort. Even with today's miracle insulations, it's tough to keep warm after an hour in 33° water.

The most common whitefishing station occurs in a large river where a riffle drops off into a deep hole. The fish bank up in holes during the winter to escape the pelting by slush ice that occurs in shallow water. They especially favor the heads of holes because food regularly tumbles into them from the riffle above.

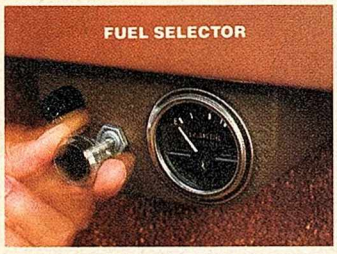
The secret to catching a mess of whitefish lies in helping nature along. You wade out into the riffle, do a dance (kicking rocks loose from the bottom) and grind your feet down into the rubble. This dislodges whatever food might be there—mayfly, stonefly and caddis

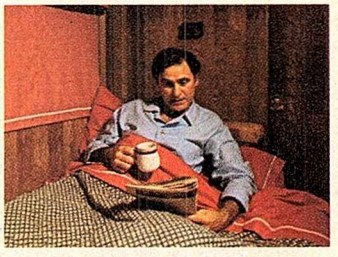
(Continued on page 129)

SPORTY whitefish (inset) can be a winter blessing for anglers with cabin fever. The most common whitefishing station occurs in a large river where a riffle drops into a deep hole. In a good spot you can take 30 fish an hour.

WINNEBAGO.

We have plans to make your money go further.





To begin with we've introduced a new Dual/Fuel System, a timely option that lets you switch your engine from gasoline to clean-burning, readily available LP gas. You have miles of extra driving range at the touch of a knob on the dashboard.

But that's not the only reason your motor home dollars buy more mileage in a Winnebago. There's Winnebago construction, solid, safe and long-lasting. There's Winnebago service, available coast to coast across North America, even in Alaska. And finally, Winnebago's traditionally high resale value.

You'll see more important Winnebago "extras" featured below. Check them over, then look up your Winnebago dealer. He's in the Yellow Pages of your phone book.

WINNEBAGO®

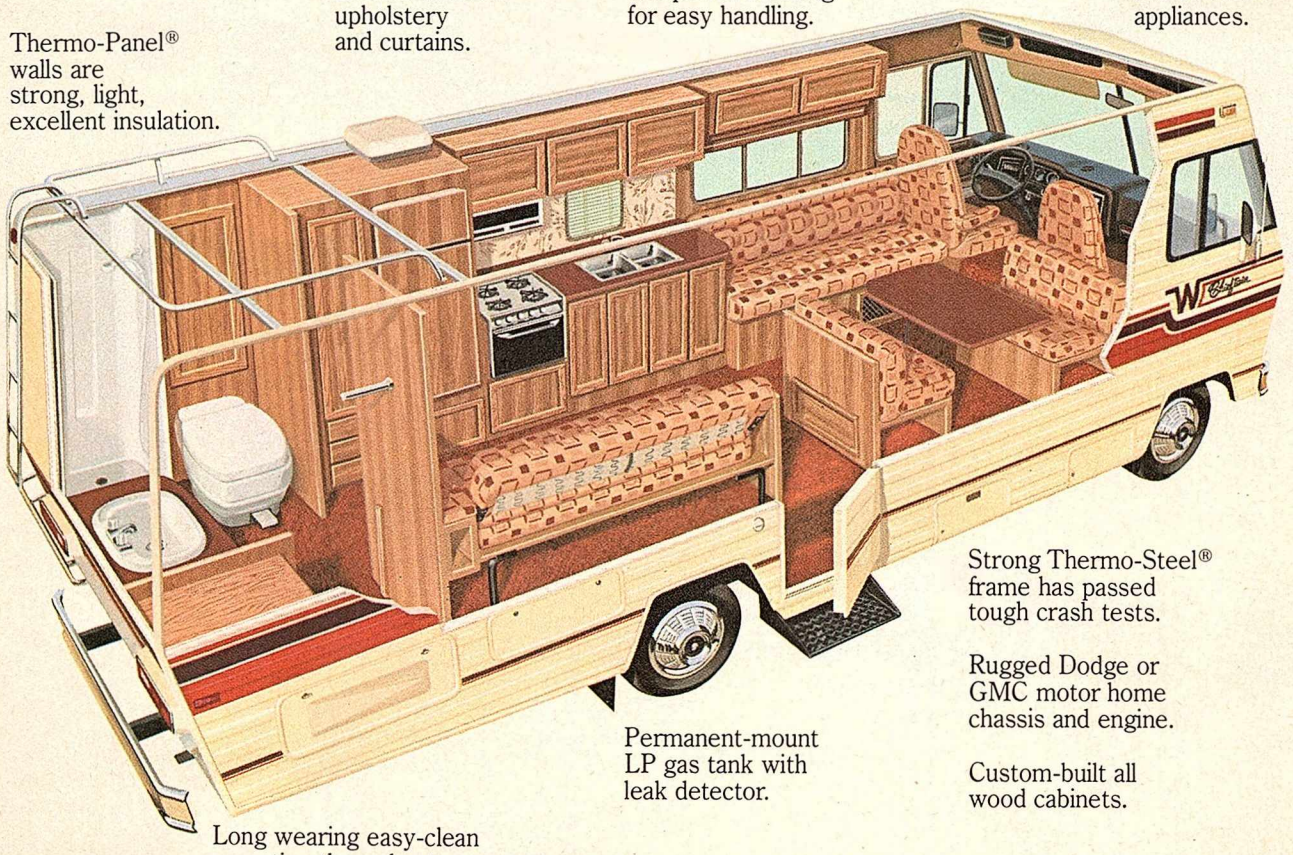
Winnebago Industries, Inc.
Forest City, Iowa 50436.

Durable, custom-tailored upholstery and curtains.

Power brakes and power steering for easy handling.

Quality-made name brand appliances.

Thermo-Panel® walls are strong, light, excellent insulation.



Strong Thermo-Steel® frame has passed tough crash tests.

Rugged Dodge or GMC motor home chassis and engine.

Custom-built all wood cabinets.

Permanent-mount LP gas tank with leak detector.

Long wearing easy-clean carpeting throughout.

It's time you considered more of a truck!

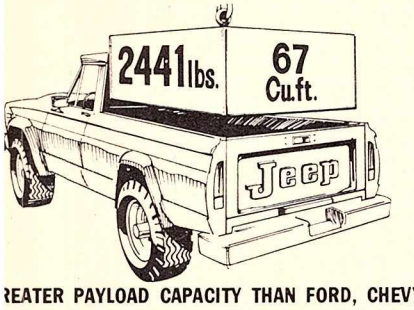
Jeep Truck

Rugged. Durable. Tough. Dependable. Go-anywhere and do-anything. They're what you expect from a truck. And they're what the name Jeep stands for! So, isn't it time you considered a truck built by Jeep? A truck that delivers all the rugged dependability that Jeep is famous for plus exceptional payload capacity, high ground clearance, low loading height and a roomy, comfortable cab. Jeep Truck has all of these and one thing more: Jeep 4-wheel drive that's built in, not added on, for unsurpassed traction. A truck that's built Jeep tough! Compare it to the competition; we think you will be very impressed!

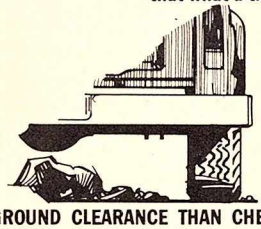
Jeep®

We wrote the book on 4-wheel drive

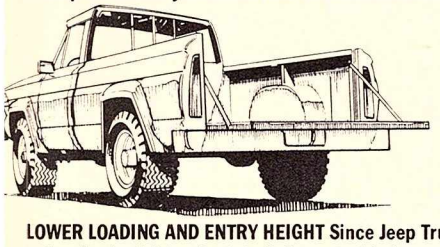
Jeep Corporation, a subsidiary of American Motors Corp.



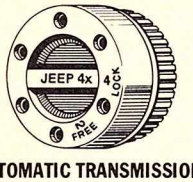
REATER PAYLOAD CAPACITY THAN FORD, CHEVY AND)DGE More cubic feet than all three, too! Jeep Truck lets you haul more! And when you get down to it, isn't that what a truck is all about?



GHER GROUND CLEARANCE THAN CHEVY AND DODGE Sooner or later, you'll find yourself in a situation where a little extra ground clearance means the difference between getting hung up or easily driving away. Jeep Truck lets you clear rocks and obstacles easily.

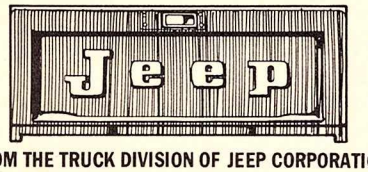


LOWER LOADING AND ENTRY HEIGHT Since Jeep Truck has 4-wheel drive that's built in, not added on as an option, it doesn't have the "on stilts" look of competitive trucks with 4-wheel drive. It sits lower. A real advantage when you're loading lots of heavy gear or climbing in and out.



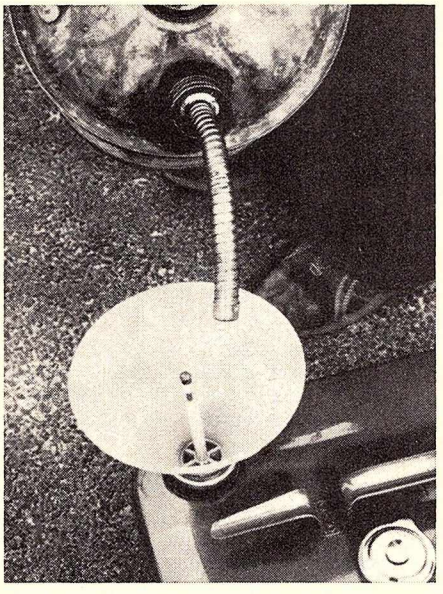
LOCKING HUBS AND AUTOMATIC TRANSMISSION FOR BETTER PERFORMANCE Locking hubs are standard for 1980, allowing you to disengage front wheels when 4-wheel drive is not needed—a good way to save wear and tear on the drive train. And now part-time 4-wheel drive is available with automatic transmission to give you top performance! Quadra-Trac®, Jeep's exclusive, automatic 4-wheel drive system, is also available for unsurpassed traction.

LOT OF TRUCK FOR THE MONEY The Jeep Truck has a lot going for it—including a very competitive price. So, come on in, check us out, go for a test drive. Isn't it time you considered more of a truck?!

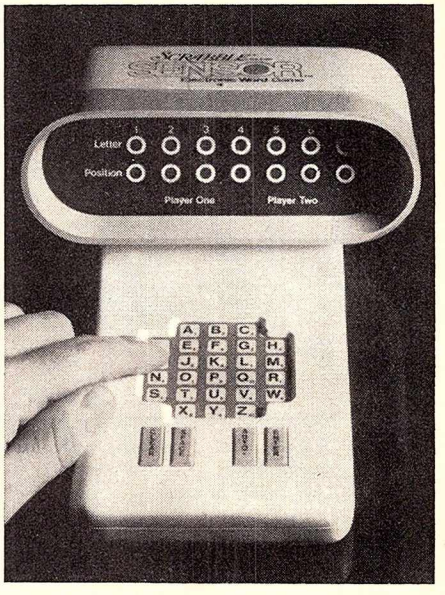


FROM THE TRUCK DIVISION OF JEEP CORPORATION

IT'S NEW



REFUELING funnel is made for many types of tanks. It has four neck adapters and a gauge rod with float to prevent gasoline spillage. Saftee Pour-Master is $5.98 pp.
Ken Howell Enterprise, 5138 Imperial Highway, Lynwood, Calif. 90262



ELECTRONIC word game called Sensor from Selchow & Righter (the Scrabble people) may be played by one or more. Object of game is to guess computer's or opponent's word in fewest turns. $35.

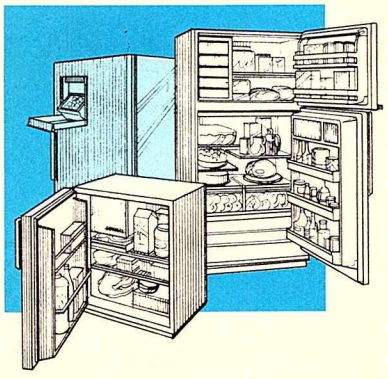
GIFT-GIVING problems may be solved with Buxton's Ladies' All-Together Clutch ($27, above, top) in plum or taupe or Men's Deluxe Thinfold ($18, bottom) in taupe or clay.

DESIGNED for astronomical and terrestrial viewing, Voyager 6001 refractor telescope (above) sports 60mm lens. Made of aluminum, it's less than 7 lbs. $253.95.
Edmund Scientific, 7782 Edscorp Bldg., Barrington, N.J. 08007

FOR outdoor and water sportsmen, two new water-resistant pairs of Mariner binoculars are offered by Minolta. They are 8x40 (l.) for $280 and the 8x32 (r.) for $260.

Consumer's Guide to:

REFRIGERATORS



PRESERVING food by keeping it cold has been a practice of humankind since ancient times. Egyptians wrapped food in wet cloths to cool it—a primitive type of refrigeration. More recently, folks used ice, chopped from lakes during winter, in two-door boxes, one for the ice, the other for the food.

These days, when you need to preserve the family stores, you simply stick them in the fridge.

The convenience of refrigeration isn't permanent, though. Refrigerators do wear out and have to be replaced. When you need a new one, it's best to size up your needs. Would you like a few fancy extras? Or do you need a larger model because your family's gotten larger?

If you want energy-saving models, there are a few recent innovations, too.

For instance, on its new models Amana puts 2 in. of foam insulation around the refrigerator compartment (formerly 1¾ in.) and 2½ in. of foam around the freezer. And, instead of fiberglass insulation alone in the door, Amana goes for a combination of fiberglass and foam. Generally, the most energy-efficient refrigerator is the one with foam and thick walls.

You can also conserve electricity with an energy-saving switch. On hot, humid days, moisture can collect on the cold metal surface of a refrigerator. Therefore, most manufacturers run wires under the refrigerator's skin to heat the metal and avoid condensation. But on dry days you don't need the heat. The energy-saving switch turns off the wires, reducing power consumption by 10 percent. Some manufacturers solve the problem by piping the refrigerator's warm exhaust air into the outer shell. The advantage of this design is that you never have to think about it. The disadvantage is that you can't shut off the heat. Some inevitably seeps into the refrigerator compartment, making the appliance work a bit harder to keep cold.

Another way to save energy is by choosing a refrigerator no bigger than you need.

As a rule of thumb, a family of two needs at least a 6-cu.-ft. refrigerator. Add 1 cu. ft. for each additional person. Add another 2 cu. ft. if you have frequent guests. Unless you have a separate freezer, the refrigerator's freezer compartment should have 2 cu. ft. per family member. Refrigerators range in price from a Sears 1.74-cu.-ft. compact model for $129 to an extra-large, 27.6-cu.-ft. model for $1,430 from Admiral.

Consider which way you want the door to open for convenience in your kitchen. Most doors are hinged on the right as you face the refrigerator, but you usually can order a left-side hinge. And some refrigerators (such as those from Kelvinator, GE, Amana and Montgomery Ward) have doors you can adjust to open on either side. That could be a plus if you plan to remodel or move. On most refrigerators, the doors open flush, so you can have the hinge against a wall and still open the door.

Frost cuts efficiency. In a manual-defrost refrigerator—such as Montgomery Ward's 12.2-cu.-ft. model for $290—you set a control for defrosting, then reset it to normal afterward. Some models are semiautomatic. You press a button to start defrosting, then the refrigerator sets itself to normal later. But most refrigerators sold today are automatics, defrosting on their own. Cycle defrosters periodically melt away the frost inside. Frost-free models have the cooling coils outside the refrigerated compartments and blow in cold air by means of fans, with the external coils periodically defrosting.

Manual-defrost refrigerators are less expensive. For example, Whirlpool's 14-cu.-ft. manual model is $360, compared to a Whirlpool 13.2-cu.-ft. cycle defroster for $400 and a 14.4-cu.-ft. frost-free model for $450. Admiral's 12.2-cu.-ft. manual is $370, while Admiral's 12.2-cu.-ft. cycle defroster is $450.

You can still buy refrigerators with a built-in freezer compartment. Sears has a 12.7-cu.-ft. manual defrost for $280. Admiral makes manual models for $340 (10 cu. ft.) and $370 (12.2 cu. ft.). Whirlpool offers a 14-cu.-ft. manual for $360.

However, models today are mostly refrigerator/freezer combinations, with a separate door for each compartment. The freezer keeps foods colder, usually 0° or below, which is important if you keep foods frozen for more than 2 wks.

Should you buy a combination refrigerator with the freezer on top, on the bottom or on the side? Top-freezers are the best-sellers because they generally cost $100 to $300 less than side-by-side models. For instance, Whirlpool's top combination model with the freezer over the refrigerator is $880 (21.3 cu. ft.); its top side-by-side combination (21.7 cu. ft.), is $1,140. On the other hand, if you like to store a lot of frozen foods, you can usually find a side-by-side with more freezer space.

Today's refrigerators offer more gadgets and refinements than ever. GE's are equipped for electronic service checks that take 6 min. You don't need to move or even unplug the refrigerator.

Admiral's side-by-sides have built-in wine racks for chilling. Six Whirlpool models have a built-in tray that slides out and becomes a decorative way of carrying hors d'oeuvres or desserts from refrigerator to table. Most manufacturers now offer side-by-sides with dispensers for ice and chilled water in the door.

Other options offered today that are worth considering? Slide-out shelves are a convenience. So are crispers, a butter compartment, a foot pedal for opening the door when your hands are full, an automatic ice maker and pull-out trays and baskets in the freezer section.

Also, the more shelves, the better. You can always remove extra shelves if they're in the way.

A good refrigerator should last 16 yrs., but sooner or later it may need repairs—thus it's important to make sure the dealer or someone else nearby can handle parts and service.

Energy consumption amounts to 58 percent of the expense of owning a refrigerator. Thus, the extra you might spend for an energy-efficient refrigerator could be worth it. And a refrigerator too large for your family's needs is energy wasted. You can save a considerable amount of electricity simply by installing your refrigerator away from heat sources, such as hot-air ducts, ovens and direct sunlight.●

We wouldn't trust this job to anything but a Lufkin.®

My kids will play on this patio when it's finished. My wife will barbecue on it. And rock the baby carriage on it. That's why we won't trust this job to anything but a Lufkin measuring tape made by Cooper the Toolmaker.

Like this Lufkin Mezurlok.® It has a positive lock so the blade won't creep while I take my measurement and throw the job a little bit off.

And a patented bumper that helps keep the tip from breaking off.

Plus they made the case from the strong stuff football helmets are made of, so it'll be hard to break—even if I drop it, or step on it.

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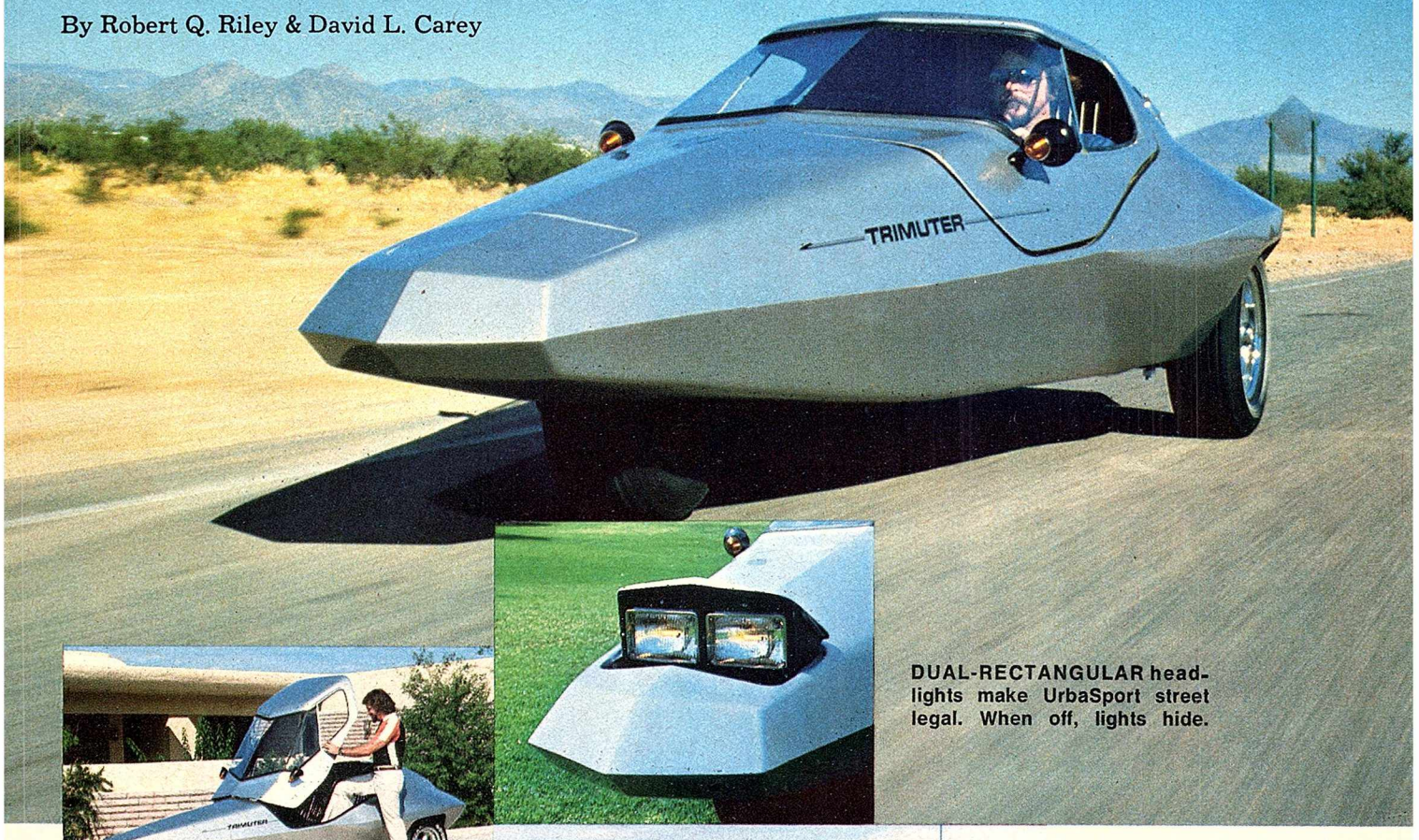
Lights: 12 mg "tar," 0.8 mg nicotine—Kings: 17 mg "tar," 1.0 mg nicotine av. per cigarette, FTC Report May '78

Build UrbaSport— A Car for All Reasons

By Robert Q. Riley & David L. Carey



DUAL-RECTANGULAR headlights make UrbaSport street legal. When off, lights hide.

GETTING into the Trimuter is facilitated by gas cylinders that help raise canopy. Inside it's snug, like fighter plane's cockpit.

NOT common sight on our roads (yet), UrbaSport Trimuter moves easily with traffic. Electric, gas versions both top 50 mph.

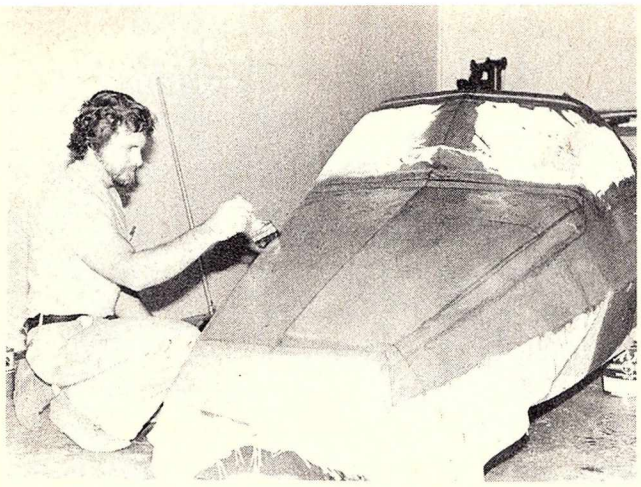
BACK in 1975 we started the Urba series of build-it-yourself cars with UrbaCar. We followed that up in '77 with Urba Electric. There were good reasons for building those cars at the times we brought them out. There still are plenty of good reasons for building them. You only have to check the price of gas and the crowds at the pumps and on the highways.

Now we have the latest in the Urba family line—UrbaSport. And it's a personal transportation machine for now, for all the same good reasons, plus some. And, like its predecessors, you can build it yourself.

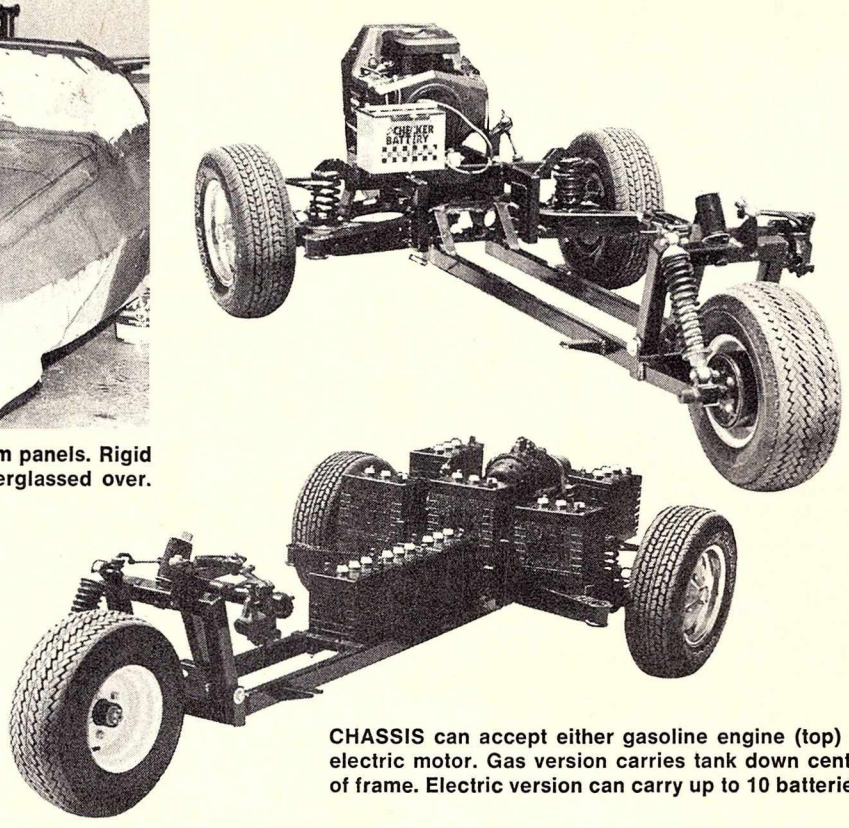
UrbaSport differs from its forerunners by having three wheels instead of four—one front, two rear. That striking design leads to the car's distinctive and efficient wedge shape. It also means that UrbaSport is a motorcycle and not a car in the eyes of the federal government. For that reason, it doesn't have to meet the extremely tough standards that new cars do.

There are some added benefits, too. It costs less to license than a car. The three-wheel chassis is lighter and has less rolling resistance than a four-wheel. It also has an easier-to-build front suspension and steering assembly.

In addition, UrbaSport can be built with either a gas engine or electric motor for power. Both chassis and body are designed to accept either. That makes the two-seat UrbaSport an ideal commuter



BODY of rig is made of 1-in.-thick urethane-foam panels. Rigid material is cut to size and shape and then fiberglassed over.



CHASSIS can accept either gasoline engine (top) or electric motor. Gas version carries tank down center of frame. Electric version can carry up to 10 batteries.

vehicle—sort of a commuting three-wheeler. Matter of fact, that's how we look at it. So we gave it an appropriate name. We call it UrbaSport Trimuter.

The gasoline version gets 50 miles to a gallon of regular gas, about the same as a large motorcycle. The electric version runs 50 to 60 miles on a single charge. Either version can reach a top speed of 60 mph, enough to get you a ticket anywhere in the U.S. Cost is about $1,900 for the gas version and about $2,700 for the electric version. Plans cost $15 and cover both models.

Styling is clean and functional. The sleek, aerodynamic shape lets UrbaSport slip through the air with minimum drag. The clamshell canopy makes for easy, unobstructed entry into the low-profile body. Two nitrogen cylinders, one mounted on each side of the canopy, provide an assist against the weight of the canopy so it can be opened or closed with just a nudge.

To enter, you step over the side and slither down into the contoured bucket seat formed into the fiberglass body. You see, you don't ride UrbaSport, you wear it like a close-fitting overcoat. It fits like it was molded to your body. It's a comfortable, snug feeling, something like you might expect to feel inside the cockpit of a fighter plane.

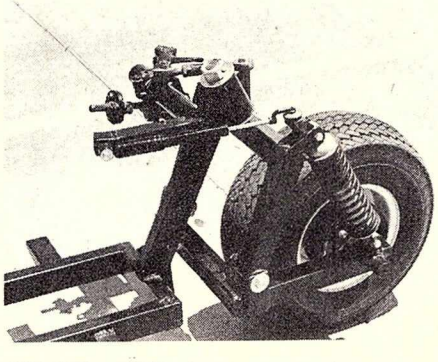
The few controls inside are within easy reach on the stainless-steel-covered center console. A rectangular-shape rocker switch on the left of the console operates the hidden headlights. A toggle switch to the right of the headlight switch operates the turn signals (they beep). A rocker switch on the right turns on the accessories. A large black button just behind the other switches is the horn and it falls right under your hand if you're using the console as an armrest.

Flipping the accessories switch lights up a dash-mounted LED digital display instrument package and an on-board computer. UrbaSport has no dial gauges. All such information, including speed, is given as digital readouts. The computer, located between the two instrument pods, gives readouts for fuel consumed, distance traveled, instant miles per gallon, average miles per gallon, time of day and time elapsed since the trip began.

These LED instruments are about $500 worth of extra goodies and are not included in our estimated cost to build. Our original idea was to install the computer so we could have instant mpg figures for the gas-power prototype. Once we got hooked on the LEDs, though, things simply got out of hand. They are a fun, but expensive, luxury.

The 16-hp Briggs & Stratton 2-cyl. engine is mounted in the rear over a Datsun differential and comes to life with a flick of the key switch. Since the transmission in the gas-power rig is an automatic centrifugal unit, similar to those in snowmobiles, there is no gearshift. The transmission is in Neutral

(Continued on page 136)



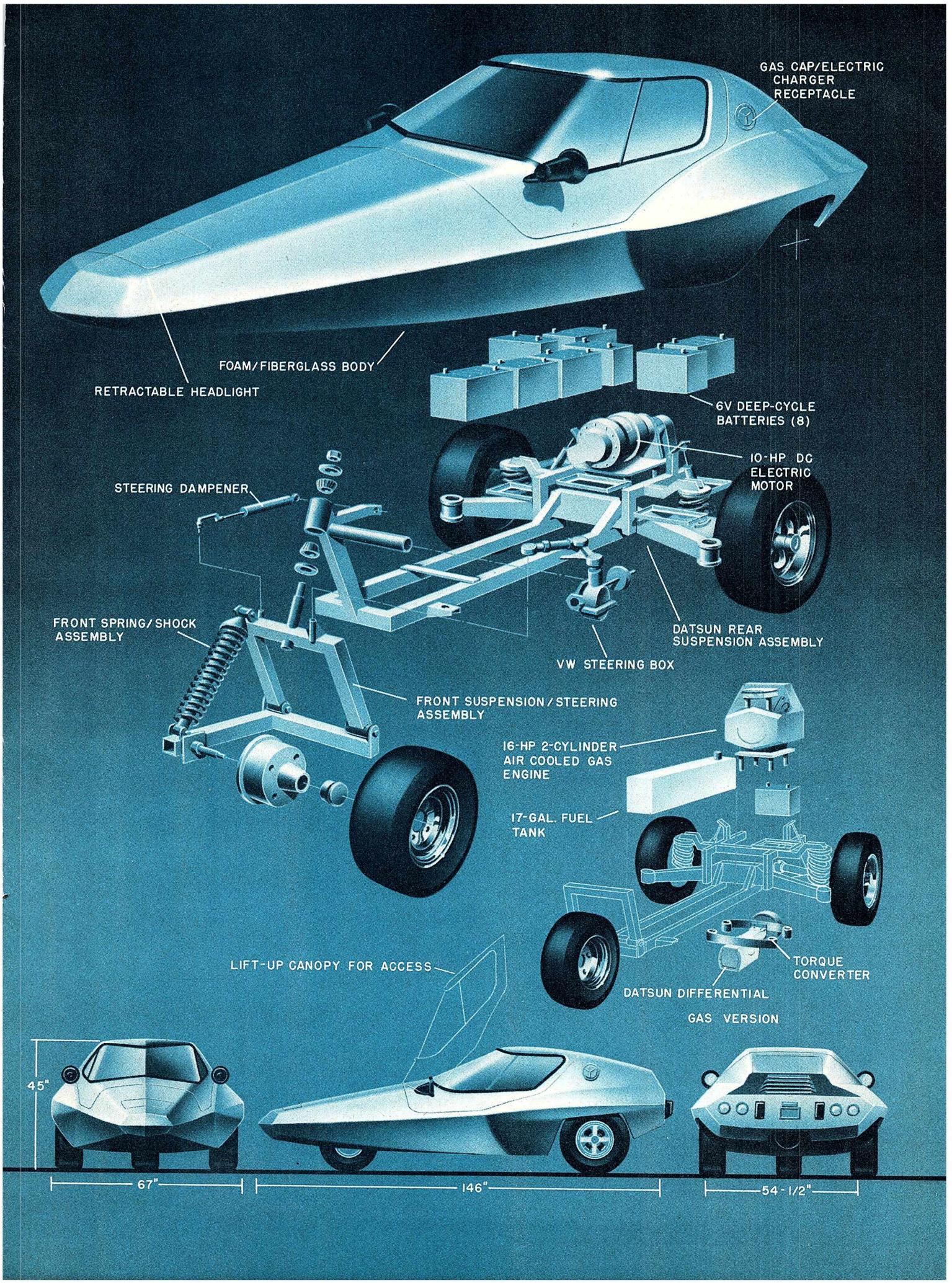
SINGLE-WHEEL front suspension sports wheel and brake assembly from a trailer. Steering box and dampener are from VW.

PLANS AVAILABLE

A complete UrbaSport Trimuter Plans Package is available from Mechanix Illustrated.

The package includes a 28-page booklet with step-by-step photos. There also are 12 sheets of plans, each a large 17x22 inches. The plans are for both the gas and electric versions. Also included are tips on how to find many of the parts, as well as other useful information.

For a complete set, send $15 (check or money order) to Mechanix Illustrated, P.O. Box MG, 32275 Mally Rd., Madison Heights, Mich. 48071. Specify Plans Package C-2-80.


GAS CAP/ELECTRIC CHARGER RECEPTACLE
FOAM/FIBERGLASS BODY
RETRACTABLE HEADLIGHT
6V DEEP-CYCLE BATTERIES (8)
10-HP DC ELECTRIC MOTOR
STEERING DAMPENER
FRONT SPRING/SHOCK ASSEMBLY
DATSUN REAR SUSPENSION ASSEMBLY
VW STEERING BOX
FRONT SUSPENSION/STEERING ASSEMBLY
16-HP 2-CYLINDER AIR COOLED GAS ENGINE
17-GAL. FUEL TANK
LIFT-UP CANOPY FOR ACCESS
TORQUE CONVERTER
DATSUN DIFFERENTIAL
GAS VERSION
45"
67"
146"
54-1/2"

3 Cabinet Beauties You Can Build Fast

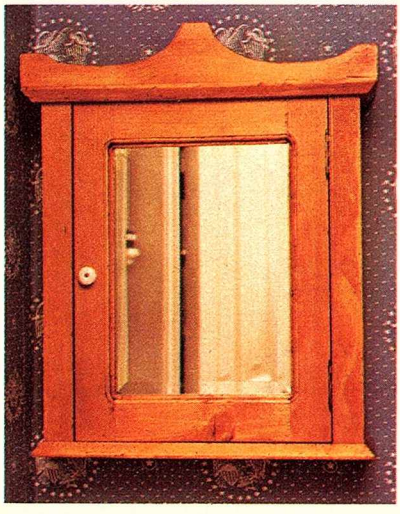
By Bruce Murphy

Cabinetry you build yourself is one of the most fulfilling goals in woodworking. Period pieces especially are rich in character, as well as tremendously useful articles of furniture. Some smaller pieces also are particularly good starter projects because of size and simplicity. And they go together fast.

With this in mind, we asked cabinetmaker Bruce Murphy to build three little wall-mounted beauties that range in detail from simple to moderately complex. The mirrored cabinet is the most basic, the spice cabinet with raised-panel door more involved and the corner cabinet an interesting exercise in mitered joinery.

Whether you build one or all three, one thing's for sure: You'll want to see more MI cabinet projects you can build. They're on the way in future issues—and are built to please as much.

Mirrored Cabinet



WE STARTED the mirrored shaving cabinet by making the frame out of ¾x2½-in. stock. Glue the frame with ⅜x2-in. dowels and bar-clamp to dry. Then, cut a ¼x⅜-in. rabbet along the inside edge of the frame to fit the 10x14-in. mirror. The molded front, inside edge can be cut with a router and a Roman ogee bit and guide.

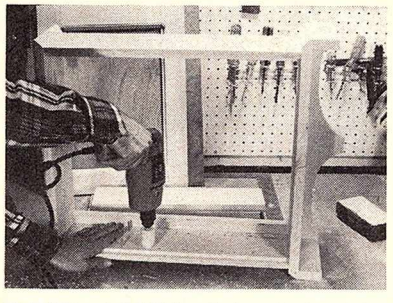
Next, join the front door rails to the sides by cutting a ⅜-in. square rabbet along both pieces and glue them together. This makes for twice as much gluing surface and results in a stronger joint. Now is a good time to cut the ¼x½-in. rabbet along the inside back edge of the two sides for the cabinet back.

Cut the cabinet base and top to size. We beveled the edges of both pieces at 40° angles on a jointer. It also can be done with a radial saw. Glue and nail the top and bottom to the two sides and bar-clamp to dry.

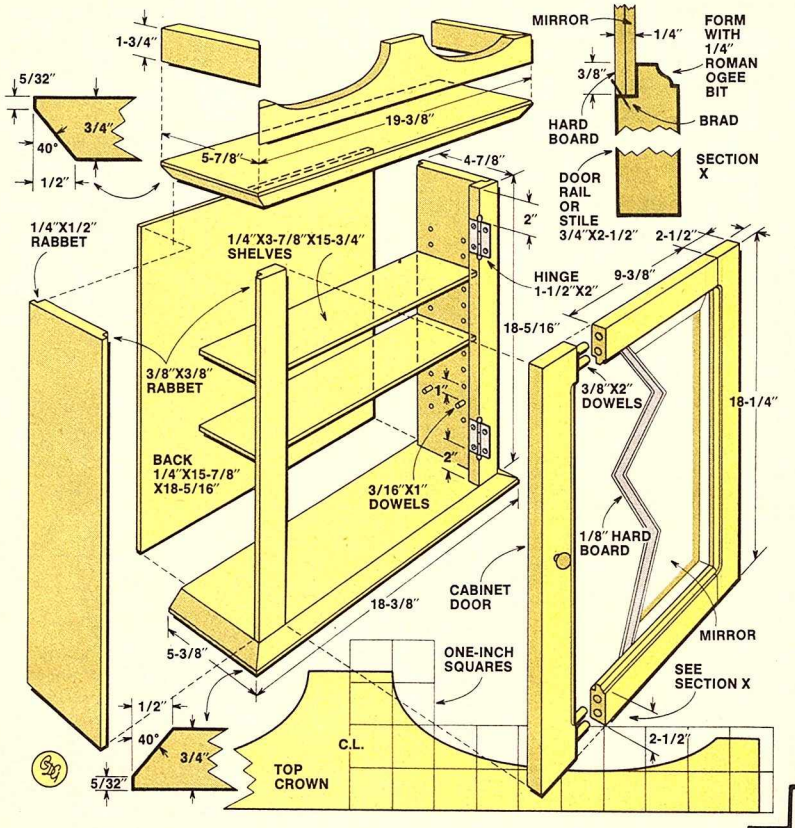
While this is drying, cut the curved top cornice piece for the cabinet. We used a band saw and cut it out of ¾-in. stock. We mitered the corners to fit along the top edge. Then, we edge-glued and clamped them to the cabinet top to dry.

So the two cabinet shelves can be raised or lowered, we drilled a series of 3/16-in. holes ½ in. deep and 1 in. apart along the back and front of the cabinet sides. Then we cut 1-in.-long 3/16-in. dowels for movable shelf supports. You should use a drill stop when drilling these holes—you don't want to accidentally drill through the sides. With this done, cut the back piece and glue and nail in place.

After sanding and staining, put the mirror, hinges and door handle in place. ●

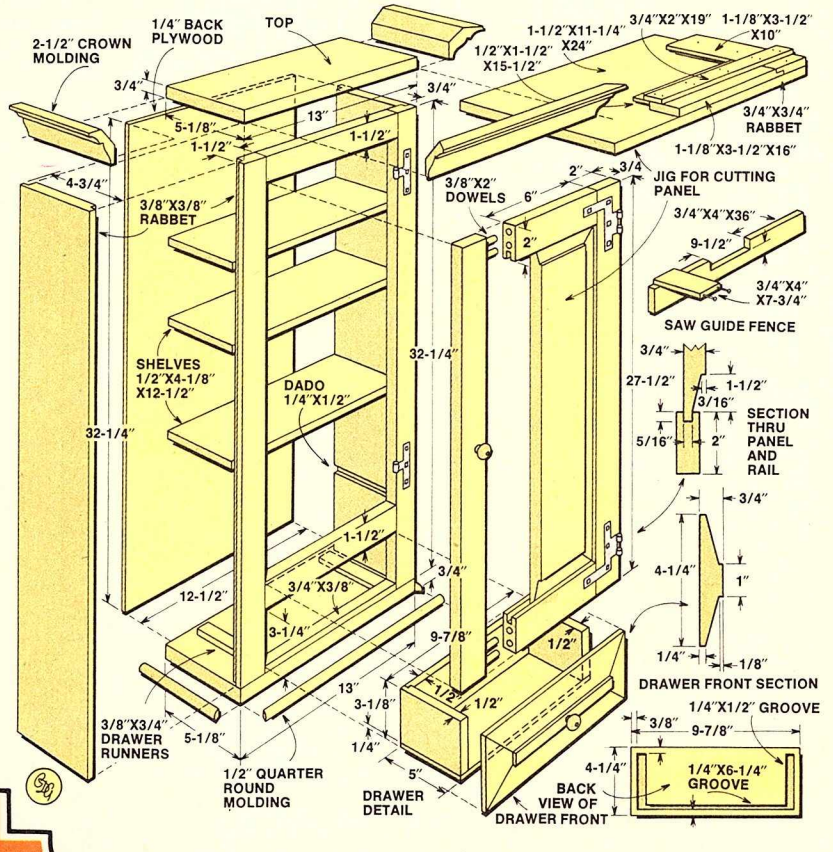


SERIES of 3/16-in. holes ½ in. deep and 1 in. apart were drilled into the sides to allow for adjustable shelves.



Photos by Tony Stellato

Spice Cabinet



THE spice cabinet's key features are a raised-panel door and drawer, both of which are made of ¾x6½x20-in. pine stock. Using a radial arm saw, we first constructed a jig to secure the panel so two hands aren't needed to hold it down. This makes cutting a raised panel safe and easy.

We also made a new guide fence to accommodate the blade in the bevel-rip position. This is necessary because the back fence pieces on the saw table must be removed for the tilted saw blade.

To cut the panel, set the saw in the bevel-rip position and tilt the blade at a 72° angle. Then lower the saw so the outside edge of the beveled panel measures $^3/_{16}$ in. The panel bevel is 1½ in. wide.

By using a carbide-tip blade, the bevels are cut in one pass. The ⅛-in. thickness of the blade tips surface the upper edges at 72°; you can sand this small angle to 90° easily. It's faster than resetting the saw at 90° and making four additional cuts along the panel's top edges.

Be sure the blade moves freely before cutting. Place the wood in the jig and make the first cut with the grain. Remove the jig arm and make the next cut cross-grain. Replace the arm and make the third cut with the grain. Finish the panel by again taking away the arm to make the last cut. Sand the panel to get rid of any saw-blade marks.

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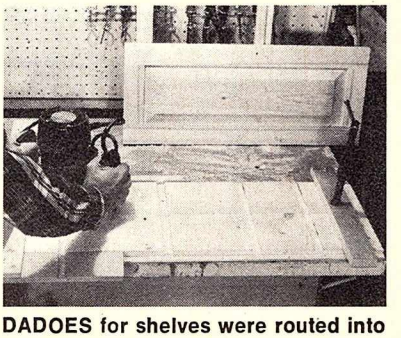


DADOES for shelves were routed into both sides simultaneously using a T-square jig to accurately guide router.

Corner Cabinet

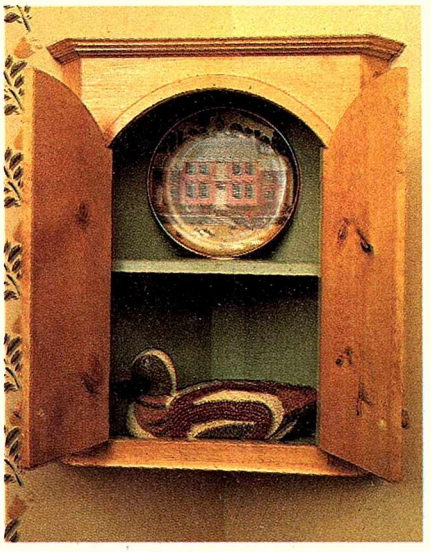
FOR THE space-saving corner cabinet, we cut the curved top portions of the two doors and matching top with a band saw. The doors were cut first—to be a guide for outlining the top section. It'll provide a better match between them.

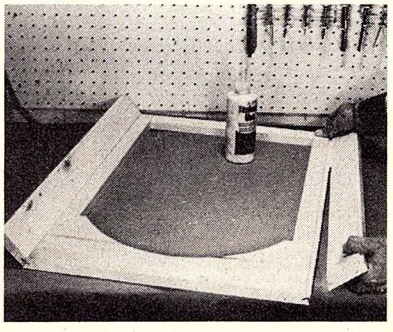
Notice that the grain of the top piece runs at right angles to the grain of the doors. Not only does this look better, it saves the trouble of having to glue stock to size.

Bevel-rip the sides and cabinet front frame edges to make 30° angled sides. With a spline, join the cabinet front and sides.

A spline is a strip or tongue of wood which binds two edges together. The spline groove should be rip-cut at a 60° angle to the 30° bevel, ¼ in. deep—right down the center of each edge. By using a carbide blade, one cut gives a ⅛-in. groove. Then cut a ⅛x½-in. piece of pine for the spline.

Before joining the front to the sides, assemble the door frame.





CORNER cabinet pieces were joined with splines along mitered edges. Use of splines produces very strong joint.

We did this with a doweling jig and ⅜x1-in. dowels. Put the frame together to be sure each piece fits before gluing. Then glue and bar-clamp it to dry.

Bevel the back edges of the 3-in. cabinet sides at 15° angles so the edges fit square to the wall. We cut this angle on a jointer-planer. With the jointer set at this angle, you can easily cut a ¼x¼-in. strip along the back inside edge to fit the ¼-in. plywood back.

With the cabinet front frame completed, see that each part of the spline fits properly. Lightly apply glue to the spline edges and beveled sides. Place them together. There's almost no way to clamp these two angled pieces, so you'll have to hold them until the glue begins to set.

Then cut the three cabinet shelves of ¾x12-in. stock. We cut the rear support post for all three shelves from stock ½x3 in. wide. The sides of this rear post were beveled to match the angle of the cabinet shelves. Not only does this piece support the shelves, it allows for irregularities in the squareness of room corners.

Edge-glue the three cabinet shelves to the back of the completed cabinet front. Then glue and nail the rear support piece in place. Give the glue time to set.

Turn the cabinet on one of its sides and nail the shelves in securely with 1¼-in. brads. Set and cover the nail heads with putty. Borden's wood putty is great for this kind of job.

Cut the cabinet's two back pieces to size out of ¼-in. plywood. We used ¼-in. mahogany.

The molding around the door

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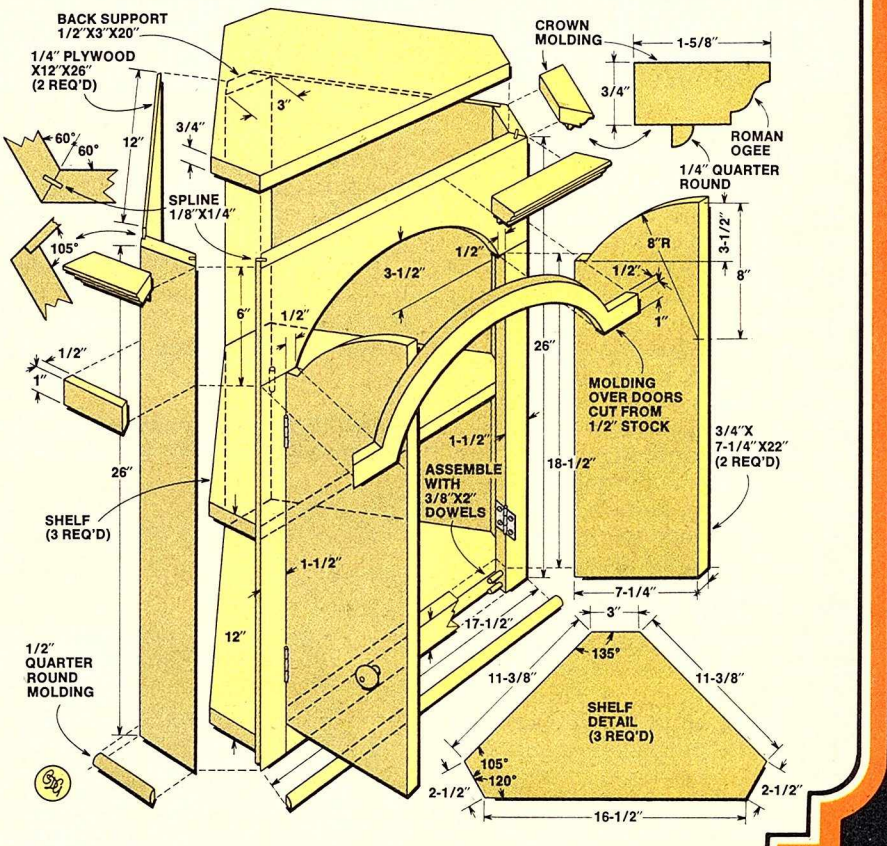


Driving Fun With a Social Conscience

By Don Chaikin
AUTOMOTIVE EDITOR

THANKS to the post-oil-embargo morality, driving for the fun of it has become downright sinful. And now, with dollar-a-gallon gas, it's a sin for the wealthy hedonist only. No more can the average Joe tool around in an inexpensive car that was built for having fun. Instead, he drives a built-for-economy car that's about as much joy to drive as a pew is enjoyable to sit in. And he only drives it to support some life-sustaining need.

Now, though, Honda has put the cheap thrill back in driving. And it's a thrill without guilt.

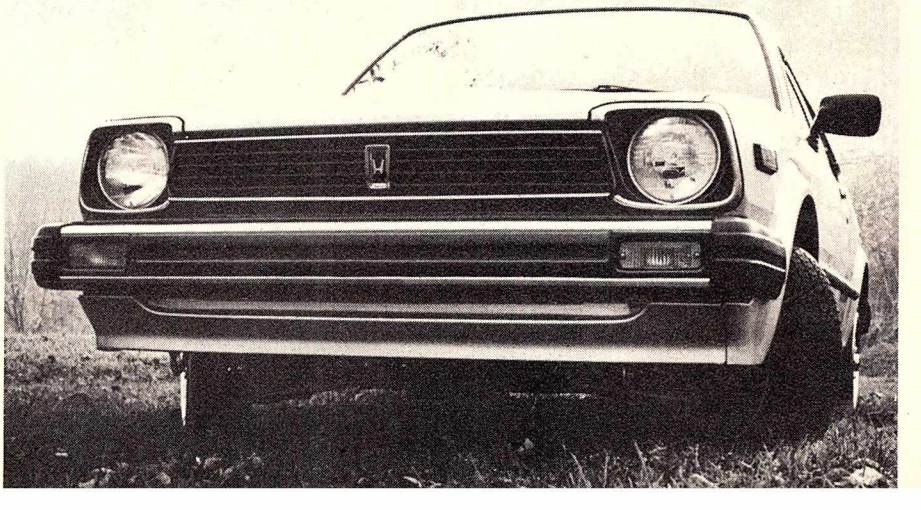
The latest version of Honda's popular little Civic front-drive economy car has been restyled and given a new chassis. The subcompact looks sharp; it rides very smoothly and quietly. It's also quite sprightly *and* very economical with the 1,488cc overhead-cam, stratified-charge Four under the hood.

Honda has taken the Civic's basic shape and made it sleeker, borrowing heavily from their successful Accord. The new two-door hatchback Civic looks very much like that rig.

In the redo, the Civic's wheelbase grew 2 inches, to 88.6. Its track widened by 2 inches, too; now it's 53.5 inches in front, 53.9 in the rear. But the car's overall length is down ½ inch, to 148. The car *used* to be small; now it's even smaller—outside.

When Honda did over the Civic's body, they also did over what's under it. The Civic's suspension is similar to the one used on its broth-

ECONOMICAL and nimble, Honda's Civic combines the fun of driving with exceptional gas economy. It offers both to the public in solid, and inexpensive front-drive car.



er, the Prelude. This includes the MacPherson-strut front and the strut and modified trailing-arm rear setup. The new suspension, along with the increased wheelbase and changes to the shock valving, give the Civic a surprisingly smooth and quite ride for such a small car.

Under the hood, Honda still offers the same driveline. The car I drove was a top-of-the-line GL 1500, so it had the 1,488cc transverse engine mated to a five-speed transmission. The engine was balky when cold and took a couple of miles of going until it was ready to roll. Even then, it tended to bog off the line. But once off that line, it moved like gangbusters. The three-valve, CVCC (Honda's version of stratified charge) engine is good for 67 hp at 5,000 rpm, but it reaches maximum torque (78.9 ft.-lbs.) at 3,000 rpm. That proves to be more than plenty to move this Honda's 1,822 pounds.

The engine moved the car, with driver, passenger and 100 pounds of dog, from 0 to 30 mph in 5.5 seconds and to 60 in 13 flat. Once at highway speeds, the little Honda had no trouble keeping up with or passing anything that was doing the speed limit.

Besides being quick, the car is nimble. The lessons learned from the sporty-coupe Prelude have been well applied to the Civic. The car is steady at all speeds and is sure in all its maneuvers. Hard cornering is typical of the breed—a moderate amount of understeer.

That understeer can be accentuated by the torque steer if you provoke it. When the front wheels are turned and you step on the gas, those front wheels let you know that they want to straighten out. The problem of torque steer is one that most makers of front drives have licked, but one that Honda is still working on. Otherwise, the Civic's steering is quick, responsive and light, front drive or not.

The GL 1500 comes wearing radials (made-in-Japan B.F. Goodrich, as a matter of fact) that help the responsive handling. The disc front/drum rear brakes stop the car quickly, too.

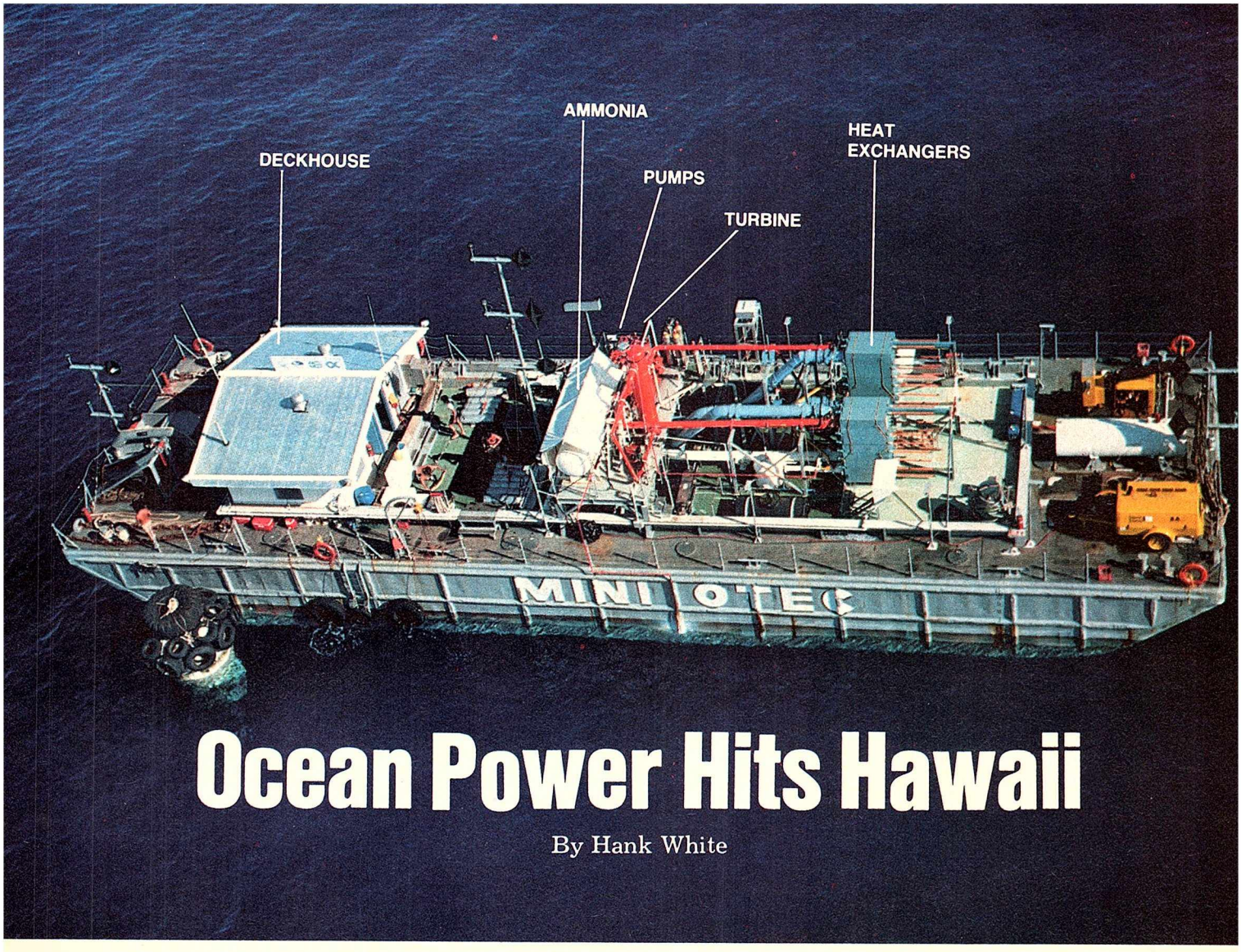
So much for the fun of driving the Civic. Now what about all this morality?

First and foremost, the Honda Civic was, and still is, an amazingly economical car. Civics have a notorious and well-founded reputation for not stopping at gas stations. And this latest version lives up to that reputation. In the world of the EPA Civic 1500s get 36 mpg city, 49 mpg highway and 41 mpg combined. In real life, of course, things are different.

In a 250-mile test run with equal amounts of city, freeway and backroad driving, the GL 1500 delivered 35.5 mpg. For the real world, that's impressive. The car's weight, efficient engine design, five-speed transmission (where both Fourth and Fifth are actually overdrives), higher final-drive ratio, along with the car's more aerodynamic lines, are the reasons for the good mileage. The Civic comes with a 10.8-gallon gas tank which, with

(Continued on page 140)

CIVIC two-door hatchback has new sleek lines reminiscent of the popular Honda Accord, especially when viewed from the rear quarter. Test car was powered by 1,488cc version of CVCC stratified-charge engine, transversely mounted, driving front wheels through 5-speed overdrive. The 4-cylinder mill is good for 67 hp and, once going, gives the 1,822-lb. car sporty acceleration. Redesigned suspension, based on Honda's Prelude, gives sure handling coupled to a surprisingly smooth and quiet ride for a subcompact car.



Ocean Power Hits Hawaii

By Hank White

WHEN you're out to prove a point, many times you have to start out small.

That's exactly what the State of Hawaii, Lockheed Missiles & Space Co. and Dillingham Corp. have done to show the faith they have in the concept of using temperature differences of ocean waters to provide a substantial amount of energy in the form of electricity.

For Mini-OTEC (Ocean Thermal Energy Conversion), a 50-kilowatt electrical generating system now operating in Hawaii, has proved that the concept works and that electricity from the sea could be a very real power for the future.

Conceived back in 1881 by Jacques d'Arsonval, a French physicist and physician and inventor of the galvanometer, OTEC is nothing more than a simple heat engine using the difference in temperature between warm surface waters and deeper, colder ocean waters to vaporize and condense a working fluid (ammonia in the case of the Mini-OTEC experiment). This energy change, in a closed cycle, is used to turn a turbine which operates a generator.

Actually, the concept is very much like the common window air conditioner, except its cycle operates in reverse. Instead of using electricity to produce heat on one side and cold on the other, OTEC *uses* heat and cold to produce electricity.

Built on a U.S. Navy dump scow, Mini-OTEC is only one-thousandth to one-ten-thousandth the size that commercial OTEC plants may attain someday. But, in miniature, she does everything that they would.

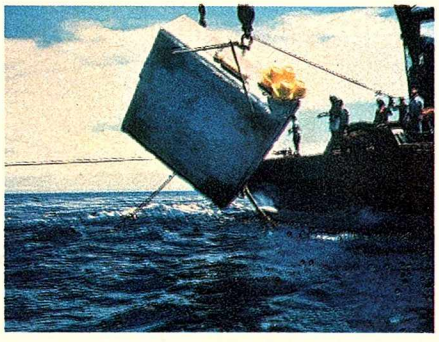
One important element of the Mini-OTEC system is her unique mooring system, which enables her to bring up deep cold water at minimum cost. Mini-OTEC is located in 3,080 feet of water about a mile and a half from Keahole Point on the Big Island of Hawaii. A 15-ton concrete block was lowered to the bottom by Dillingham and, attached to it, was 1,500 feet of nylon hawser. This line was, in turn, attached to the bottom of a 2,170-foot-long piece of 24-inch-diameter polyethylene pipe.

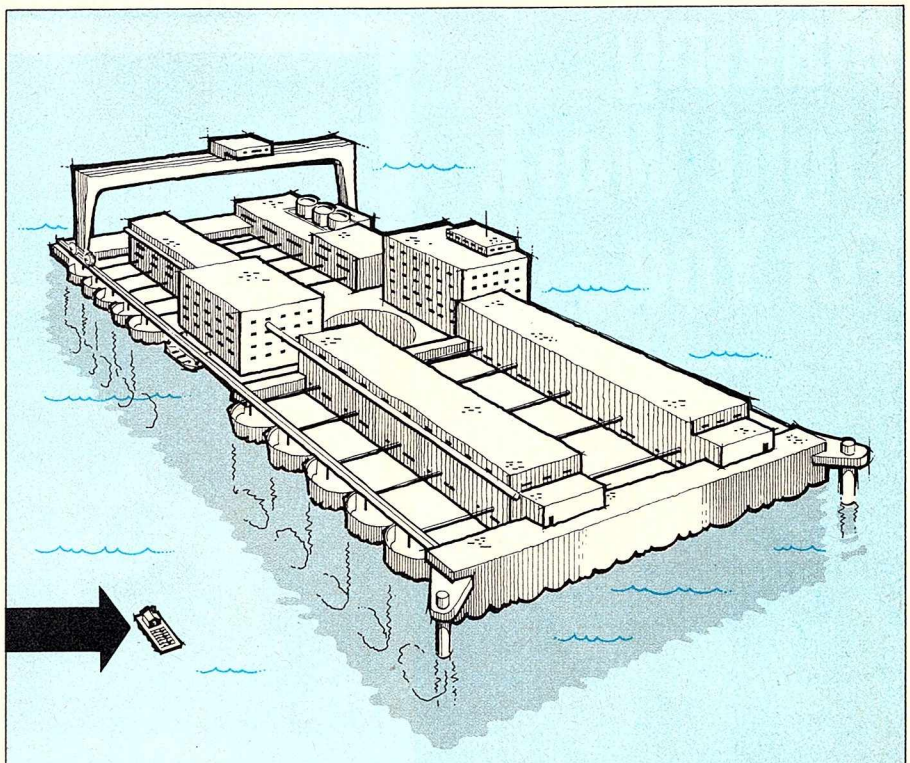
All of this mooring equipment terminates at a buoy on the surface. Mini-OTEC is attached to the buoy by a flexible cold-water transfer hose. This type of mooring system allows the OTEC plant to withstand heavy seas and winds (which are extremely rare off Hawaii's Kona coast). The overall system uses the cold-water pipe as a tensile member of the mooring system. In the event that a rare offshore wind does threaten to drag Mini-OTEC away from land, the submerged concrete block is prevented from bouncing down the 30-degree slope by a 1½-inch steel cable moored to the inshore reef.

Currently, the cold water from the depths is sucked up through the pipe system to a free sump on the barge, where it is pumped at the rate of 2,700 gallons per minute through the condenser. The water is finally mixed with an identical amount of warm water coming from the evaporator and the two effluents are discharged through a common pipe 16 feet below the surface. During the summer months, the water temperature from the 2,100-foot level is approximately 43°F and the surface water is about 81°F. In wintertime the surface water may go down in temperature to 75°F, but that still gives enough temperature difference for Mini-OTEC to operate.

Due to her minuscule size, Mini-OTEC makes just a little more elec-

CONCRETE block that holds the Mini-OTEC in position is lowered to the sea bottom. Block weighs 15 tons, is itself moored.





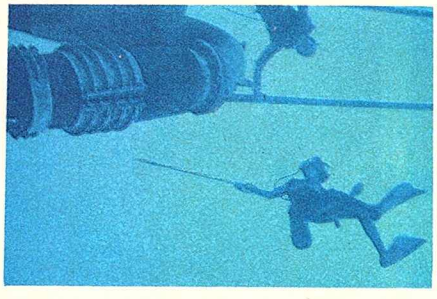
MAXI OTEC

FUTURE OTEC system of giant proportions would moor in tropical waters and grind out 100 megawatts of electricity from the temperature differences of the sea. Compared to Mini-OTEC (left), it would be a monster, complete with multistory crew quarters, water ponds and gravity-feed heat exchangers covering a large portion of the topside area. Electricity would be fed ashore by way of undersea cable on ocean floor.

tricity than is required to run all her subsystems. Her generator puts out about 50 kilowatts. Of this amount, 40 kilowatts is used in running pumps, compressors and the like. The additional 10 kilowatts burns lights, TV and small appliances for the crew who have absolutely no guilt complexes about wasting fuel.

It's quite a sensation to be aboard the barge seeing all the pumps turning away, powered silently by turbine. The only sign that might give a clue to the source of the power is the continual drip of condensation from the cold side of the plant.

What of the future? Potentially, there are two main categories of OTEC plants: Some are sited near coastlines, moored to the bottom like Mini-OTEC, and send power ashore through cables (these, however, are limited in number due to the comparative rarity of appropriate sites) others are grazing



DIVERS inspect underwater workings of Mini-OTEC plant. Cool water is brought from below in a 2,170-ft. polyethylene tube.

OTEC plants—huge ships larger than present oil tankers. They would graze along the surface of the sea looking for warm pools of water spotted by satellites. These mobile plants would convert their electrical energy into hydrogen for shipment to continental ports, where the hydrogen could be burned as a fuel, leaving only a residue of fresh water. They could also manufacture ammonia to be used as fertilizer for agricultural countries.

Mini-OTEC is a little like the Wright flyer—a lot of people have talked about the concept, but she is the first to actually generate net power from the ocean thermal resource.

Mini-OTEC was assembled mainly from off-the-shelf hardware by Lockheed using equipment from a number of sources. The plate-type titanium heat exchangers were designed, built and donated to the project by Alfa-Laval, a Swedish outfit. The turbine and generator subassembly was built for Mini-OTEC by the Rotoflow Corp. The plant's two seawater pumps each providing 2,700 to 3,300 gallons of water per minute, were custom-made by the Worthington Corp.

There is little point in running a wire ashore to sell Mini-OTEC's

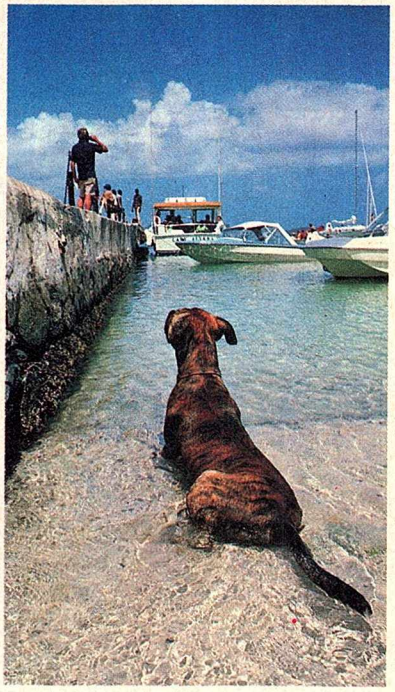
(Continued on page 140)

Making Light Work For You

By Peter Gowland

PASS a line of hucksters at a county fair and you can usually hear them calling out, "What you see is what you get!" Often enough that's true, whether it's yelled by auctioneers, rug salesmen or used-appliance dealers.

But when folks talk about their snapshots, a common complaint is that no one gets what they see. Some pictures come out too dark, others resemble the proverbial polar bear in the Arctic. And your close-ups have people looking as



OUTDOOR HARD TOP LIGHT

MIDDAY LIGHT is hard toplight. It is an excellent source for scenic shots since colors record beautifully in this type of light. However, it's just about the worst light for taking shots of people.

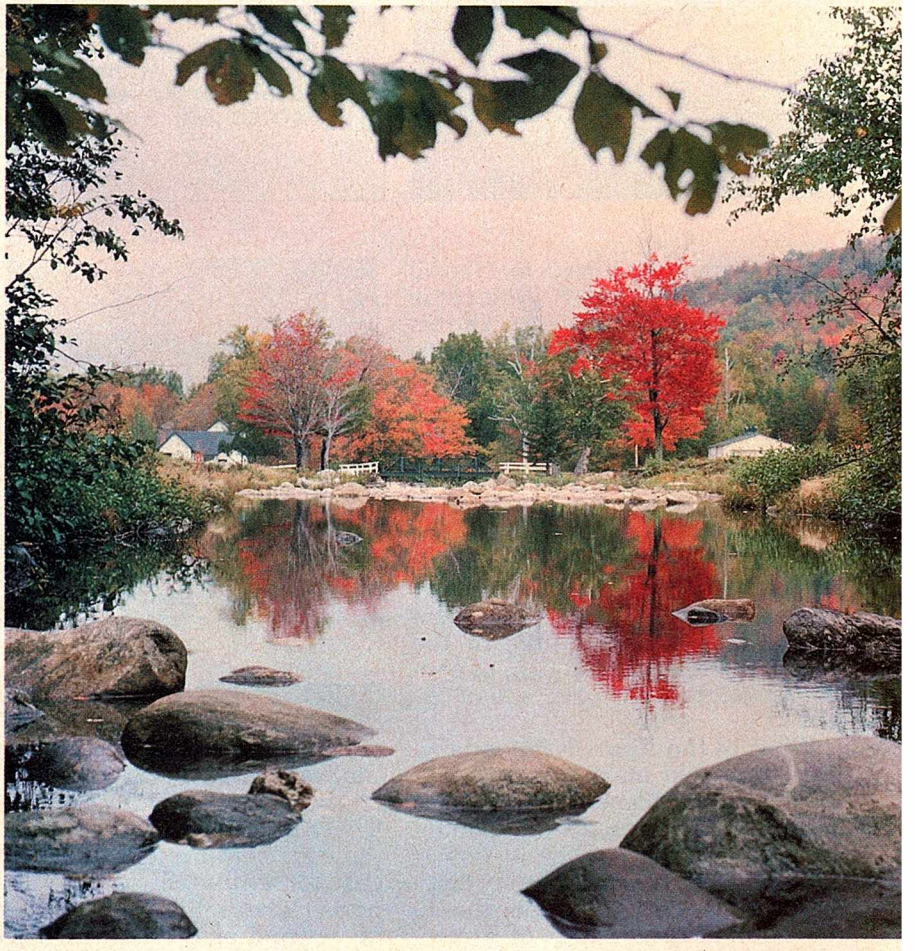
The light casts strong shadows. So close-ups of people taken with hard light usually reveal dark shadows under eyes, nose and chin. When you snap the shutter you can see the whites of their eyes, but when the film comes back all you see is two black holes.

During the middle of the day, concentrate on taking landscapes and other shots that don't require close-ups. Remember: The clearer the day, the brighter the sun . . . and the harder the shadows.

REFLECTED BOTTOM LIGHT

BOTTOM LIGHT ordinarily makes people look a little like ghouls since it causes long shadows to extend up from chin, nose and eyes. Other than for Halloween gag shots, its use should be avoided.

But, if you shoot in diffuse light and bounce that light against a backlighted subject, the result is unusually smooth tones. This technique works especially well in snapshots of children.



if someone had smeared coal dust over their eyes.

These pictures are ruined because the photographers use uncontrolled light, meaning they failed to adjust exposure or composition to fit the light that is available.

For instance, one of the most difficult problems with light is its alter ego, shadow. You have to learn what kind of shadows are around when you shoot.

If the light comes from behind you, the picture-taker, it falls on your subject in a particular way. Light coming from behind the subject casts an entirely different shadow and therefore requires different composition and exposure.

To use shadow and light to your advantage you have to learn to previsualize a scene. This means you must study the type of light present, and the shadows it creates, to get the best picture.

In the accompanying photos, we tell you about some of the main types of light you find and how to use it. ●

BACKLIGHTING WITH FILL FLASH

BACKLIGHTING is one of the most frequently used techniques. Unfortunately, it's also one of the most misused. Since a number of different photographic effects can be achieved with backlighting, it's important for you to decide on the particular light you want before you shoot.

If you're interested in silhouettes, you may have to open up the camera aperture so identifiable features can be blacked out. A portrait, however, requires more light to properly fill in all facial characteristics. Here, you may want to use a fill-in flash to supply the needed light.

OUTDOOR SOFT LIGHT

SOFT LIGHT occurs when you don't have a point source of light such as the sun or a floodlamp. It's a diffuse light that renders barely discernable shadows as it dampens color intensity, producing a more muted effect than hard light.

Soft outdoor light is extensively used in portraiture and landscapes. This kind of light can be found on overcast days or in shady spots. It contributes a hazy, subdued tone to scenic shots and its weak, nondirectional light is ideal for close-ups. The harsh shadows that mar portraits taken in hard light disappear in soft light. The result is a flattering light that gently highlights facial features and does not rudely accentuate chin and nose.

When shooting in shade, don't think there aren't shadows to deal with. Film is acutely sensitive to shadow under such conditions and you sometimes may have to use a fill-in flash.

FRONT LIGHT

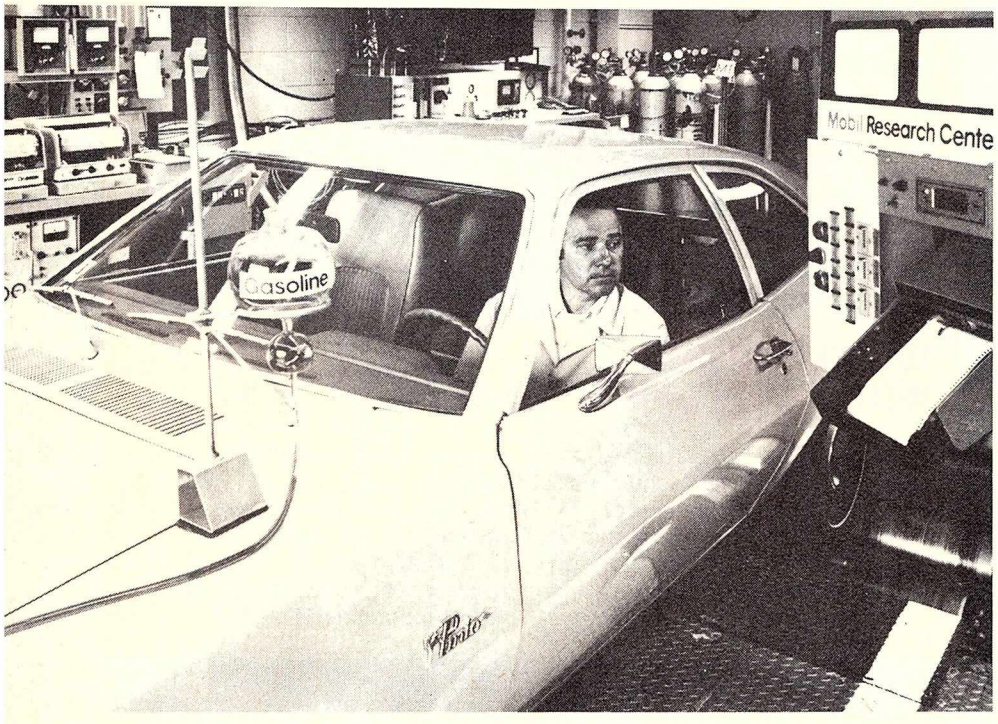
FRONT LIGHT is the most flattering portrait light and can be found in early morning and late afternoon. Outdoors, it's a low-angle light that reduces the long facial shadows which toplight casts. As a result, features are fully illuminated; there's no shadow blemish.

Yet, the long shadows that fall behind the subject produce interesting secondary effects that can counterpoint the subject. By careful composition you can use these shadows to highlight the overall picture, something that can't normally be done with toplight.

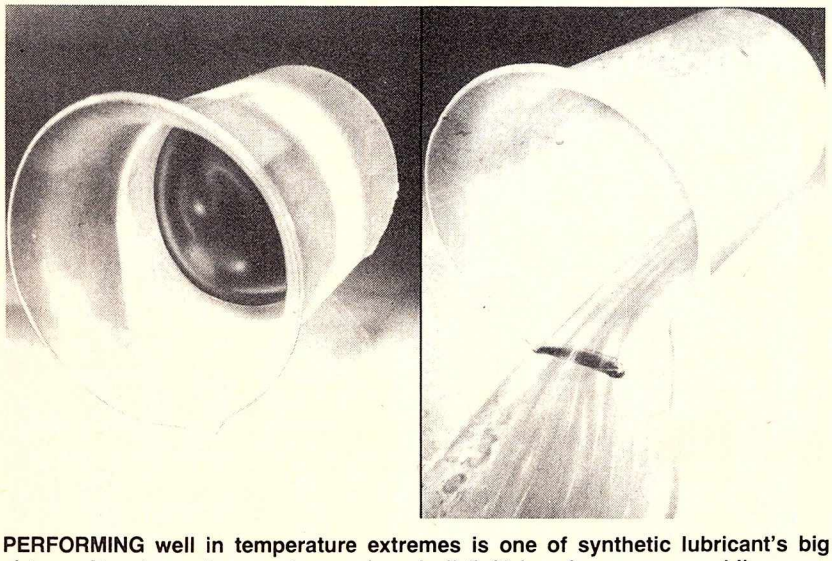
You should use this early and late light to your advantage. You'll see the difference in your pictures.

The Pseudo-Oils That Save You Gas

By Don Chaikin
AUTOMOTIVE EDITOR



TESTS have shown that synthetic lubricants use less gas than mineral-base oils. The synthetics have a strong resistance to oxidation and can be formulated in low viscosities.



PERFORMING well in temperature extremes is one of synthetic lubricant's big virtues. At subzero temperatures mineral oil (left) is a frozen mass, while a synthetic lube (right) continues to flow. Synthetics work well in extreme heat, too.

IF YOUR TV set is anything more modern than a Dumont and gives you programs more recent than *Your Show Of Shows,* it's been bombarding you with commercials for Mobil 1. Your friends at Mobil, the same folks who gave you Mobilgas, Mobiloil, Mobilube and a winged horse now offer you Mobil 1, the oil, they say, that saves you gas.

Truth is, those commercials are half right. Mobil 1 can, indeed, save you gas. But Mobil 1 isn't oil. It's a synthetic engine lubricant, not highly refined black gold.

Synthetic lubricants have been around for quite a while. They are used exclusively in jet aircraft engines where they're subjected to heat that would quickly boil away regular oil. They're used, too, in the crankcases of equipment in polar regions, where your basic oil would become one big Fudgsicle.

And synthetic lubricants have been on the shelves of auto parts stores for years. Some of the more famous brands are All Proof, Amsoil, Chemlube, Darmex Plus, Freedom Oil, Love Synthesized Lube, Lubrichem, S1-1, Ultron E-11 and Zenex. Not a household name among them, so you can see why synthetic lubricants, by and large, stayed on those shelves. Not too many people knew they even existed.

Until recently, there was no strong voice to get the message of the synthetic lubes across to the buying public. But thanks to the hefty bankroll at Mobil, the virtues of synthetics are as near as your TV, magazine or radio.

And the virtues of synthetics are now being listed in a new order. When gas was 35 cents a gallon, not too many people cared about squeezing extra miles from each tankful. In those days, the more often you filled up, the more glasses, steak knives and stuffed toys you got.

So synthetic-lube makers didn't shout that their products delivered better gas mileage than oil. Instead they said that they would stand up better in temperature extremes and would last two or three times longer than oil. Some even promised you'd never have to change engine lubricant again.

Mobil 1's ad campaign and dollar-a-gallon gas have made mileage claims the big selling point. But synthetics still are expensive, three to five bucks a quart, instead of the 75 cents a quart you might

be used to paying for oil. So what's the story here?

Synthetic engine lubes these days are one of two base stocks, with specific additives. They're either chemically formulated esters or synthetic hydrocarbons, usually polyalphaolefins (PAOs). Both esters and PAOs have their own quirks. PAOs, for instance, tend to shrink engine seals. Esters, on the other hand, tend to swell them. However, ester and PAO base stocks are compatible with each other. The lube manufacturers can therefore mix the two base stocks before formulating their lubricant and come up with a lube that doesn't affect engine seals. (It's not a good idea for you to mix ester-base and PAO-base lubes in your crankcase yourself, according to the experts at Hatco Chemical Corp., the largest manufacturer of ester-base synthetics. Some of the additives in one lube may not be good for the additives in the other.)

And both PAOs and esters are compatible with the modern crop of lubricant additives. You see, synthetic lubes, like regular engine oil, have specially formulated additives. Additives are chemicals in the lubricant that don't actually lubricate but perform other vital functions. Besides lubricating, whatever's in the crankcase has to have anticorrossive, detergent, dispersant and antiwear properties, all due in whole or in part to the additives.

Plus, the additive package includes viscosity improvers, which help a lubricant maintain its viscosity over changing temperatures.

Viscosity, simply put, means resistance to flow. A low-viscosity (thinner) lubricant flows more easily than a higher one. The thinner the lube, the easier it is for the engine to pump it around; the less work the engine has to do, the less gas it uses.

Unfortunately, gas-saving thinner oils oxidize more readily than thicker ones. The thin segments of the oil are extremely volatile, so in the heat of a working engine, they slowly boil away, leaving the thicker parts. Synthetic lubricants have a tremendous resistance to oxidation. They don't easily boil away. Therefore, synthetics can be formulated in very low viscosities.

The Society of Automotive Engineers (SAE) sets guidelines for tests to see if a lubricant meets the carmakers' warranty standards. This SAE sequence of tests is extensive and expensive. One test is for the lubricant's resistance to oxidation. An engine is run at highway speeds for 64 hours. Samples of its lube are taken every eight hours and its viscosity checked while the stuff is at 100°F.

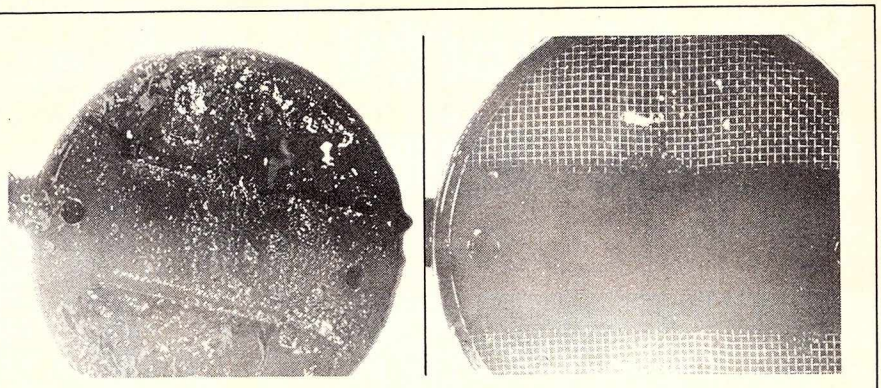
To pass the test, a lube has to be no more than four times as viscous (thick) at 40 hours than it was at the test's start. After 64 hours, all it has to do is flow. A recent comparison test showed a premium-quality conventional oil was 121 percent thicker after 40 hours and 186 percent thicker after 64. A diester-base synthetic, however, was only *15* percent thicker after 40 hours and only *18* percent thicker after 64 hours!

What all that translates to is that if you put a 20W-40 oil in your engine, it's up to 25W or 30W by the time you drain it. Not so with a synthetic. Not only does it not get thicker after use, it can start out at a gas-saving thinner viscosity than even the most expensive oils can. By the way, the first number in a multiviscosity rating is the lube's resistance to flow at 0°F, the higher number, its resistance at 210°F.

An added bonus to synthetic's gas saving is that synthetics remain free-flowing in the cold. Most of us do a good portion of our driving with a cold or only partially warmed-up engine. During these periods the engine strains to pump oil, which isn't as easy to do when the engine is warm. The synthetics, though, flow freely even in these conditions.

So between good cold-weather performance and resistance to oxidation, synthetic lubricants are being formulated in pretty low viscosities, like 10W-40. The lower

(Continued on page 117)



DURING use oil oxidizes away, leaving thick sludge in the crankcase and on parts like suction screen (left). Synthetics don't break down (right) and run clean longer.

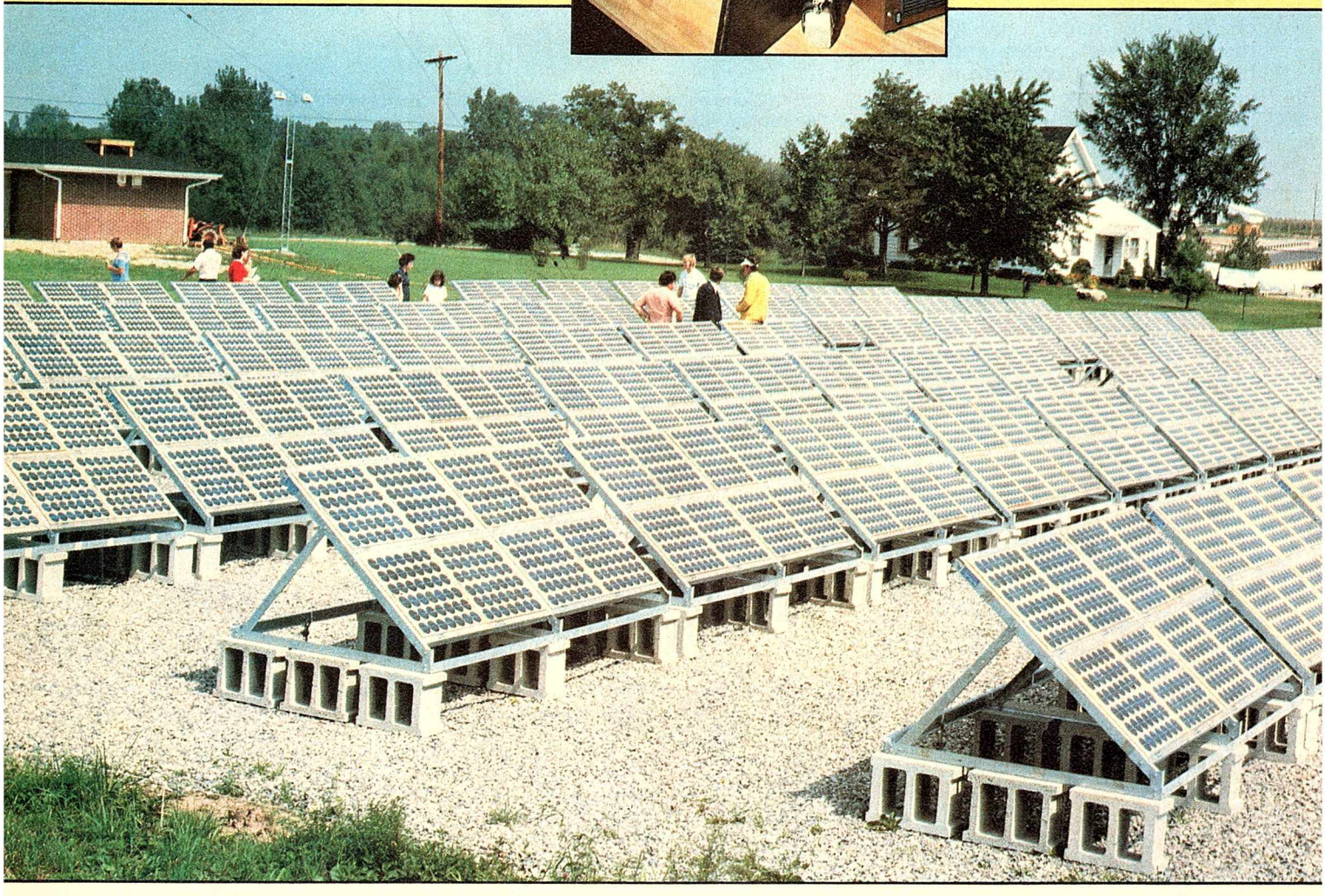
ONE of many synthetics around for years is Ultron E-11 which has a diester base stock.

LUBE industry is waiting for the impact of Mobil 1's big advertising campaign.

Sun-Powered Broadcasting

By Edward Morris

WBNO-AM in Bryan, Ohio, draws its power from 33,600 photovoltaic cells. Modules of 42 cells each are mounted on galvanized steel racks faced southward. Officials expect the system to provide 80 percent of the station's annual power demands. At station (inset) broadcasters prepare to go to work.



AT MID-MORNING, the fog is still lying thick across the flat northwestern Ohio farmland. And in a few months, this same land will be thick with snow. So it seems odd to hear a voice on the car radio proclaiming, "This is sun country!"

Well, the slogan isn't just promotional hype because what you're listening to is the world's first solar-powered commercial radio station.

WBNO-AM in Bryan, Ohio, switched to the sun on August 29, 1979. The 500-watt, dawn-to-dusk station now draws its energy from a one-third-acre array of photovoltaic cells that convert sunlight into direct current electricity. On a clear day at noon, the 33,600 cells in the array can produce up to 15,000 watts—far more than the station needs to operate.

According to Dr. Joseph Lindmayer, president of the corporation that manufactures the silicon photovoltaic cells, photovoltaic power is already used extensively in the field of communications. But until this time, most applications have been in remote microwave, radio and telemetry sites. The WBNO installation extends photovoltaics to a communications application directly impacting the public. He foresees a time in the near future when many AM, FM and TV stations will be powered by photovoltaics.

The U.S. Department of Energy provided most of the funding for the $300,000 experiment. It was designed and is being monitored by the Lincoln Laboratory at Massachusetts Institute of Technology. Participants agree that the test project will probably continue for the next 20 years.

Early results have been very encouraging. It was discovered, for instance, that the cells could generate a considerable amount of en-

ergy even through cloud cover and rain. In the first six days of operation, the station required 159 kilowatts of power—but the cells produced 170, in spite of showers and frequent overcasts. Officials expect the photovoltaic system to account for 80 percent of WBNO's total power demands on a year-round average.

The station's eagerness to cooperate was a big factor in WBNO being picked for the solar scheme. So was its location. Bryan, which has a population of 8,200, is about 50 miles west of Toledo. Because of its closeness to Lake Erie, the area is often cloudy and subject to heavy rain and snow. That sounds like a good reason to *avoid* the area for solar projects.

But says WBNO's general manager Luke Thaman: "The DOE wanted the project to be somewhere that would really put solar power to the test. And we were willing to put some money into it since we thought it would be great to be first."

What the station had to pay for was a new solid-state AM transmitter, interface equipment to convert the solar-produced DC electricity into AC and a building to house monitoring equipment and the batteries that store any surplus power the cells might generate. WBNO management also had to agree to let the general public and scientists visit the installation and have access to the research data.

Since the flow of electricity from the array is not even, the system has four large batteries, like those used in diesel locomotives, to hold the surplus. Fully charged, the batteries can power the station for about a day and a half. In fact, the station relies on the batteries for early-morning broadcasting.

When the array produces enough power for the station's primary needs and the batteries have been charged to 90 percent of their capacity, an automatic control connects additional studio, newsroom and production-room loads. If these additions still don't use up all the power, then sections of the array are automatically shut off until needed again.

Every function of the system is automated, so the station hasn't had to employ special technicians to keep it running. WBNO's 12 employees (including those who work on the nonsolar FM side) have become familiar enough with the project to act as tour guides for the swarms of visitors.

A 50-channel data logger keeps track of all performance and weather information. If any part of the system malfunctions, an alarm alerts station personnel to stop the operation until the trouble can be corrected. Reverting to power from the local utility involves only turning a switch.

All pertinent data is recorded on a small cassette which the station mails once a week to Lincoln Laboratory for analysis.

Although the cost of solar-generated electricity is presently greater than that from conventional utility sources, the gap is rapidly narrowing as a result of decreasing costs for solar cells and rising costs for conventional energy. Today, photovoltaic power costs are down to about six to eight times utility power costs. Photovoltaics are expected to become utility cost competetive in the mid-1980s.

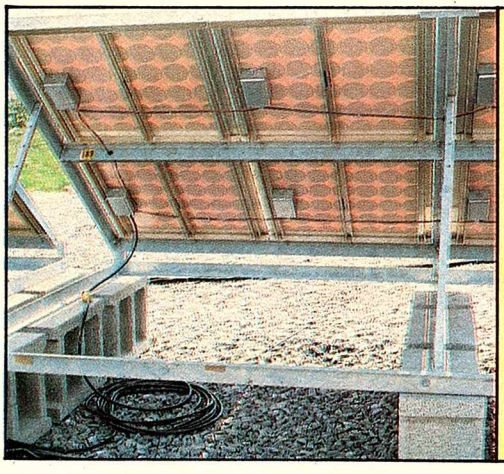
The seven straight rows of the solar array tilt to face south in a field directly adjacent to the station. The rows are 12 feet apart to prevent shadowing. Cells are arranged in modules of 42 and placed on galvanized steel racks. There are 800 modules in the array. Should any of the cells in a module be damaged, the whole module can be replaced.

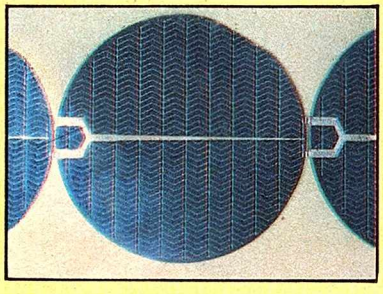
The system's designers say that the sun's relation to the earth in winter will make the cells even more efficient then than in the summer. Electrical activity within the cells and heat from the sun's rays are expected to keep the snow off the tough polyvinyl sheets that cover the cells. Tests indicate that the steel racks that hold the modules can withstand winds of 100 miles an hour. The racks are bolted to concrete blocks and ground-anchored with steel augers.

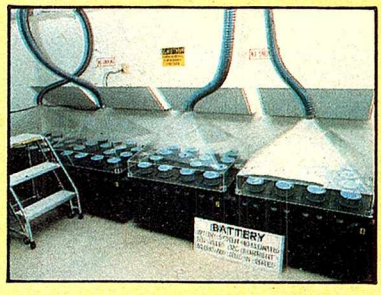
One major shortcoming of this kind of solar operation is the cost of the photovoltaic cells. They are made primarily of silicon—an abundant element—but they don't yet lend themselves to being mass-produced. Costs, however, are rapidly going down. The cells were supplied by Solarex Corp. (Rockville, Md.) at a cost to WBNO of $14 a watt, or $7 a cell, at the time contracts were let for construction material. (Cell prices are quoted in terms of watts produced. The 3-inch cells used at WBNO each can produce about ½ watt of electricity.) Recently, the same cells had been priced at $9 a watt.

Fully aware that WBNO is pioneering power research that could revolutionize the way we live, Thaman tells visitors to the station, "This is a horse-and-buggy setup compared to the one you'll have in your home someday."

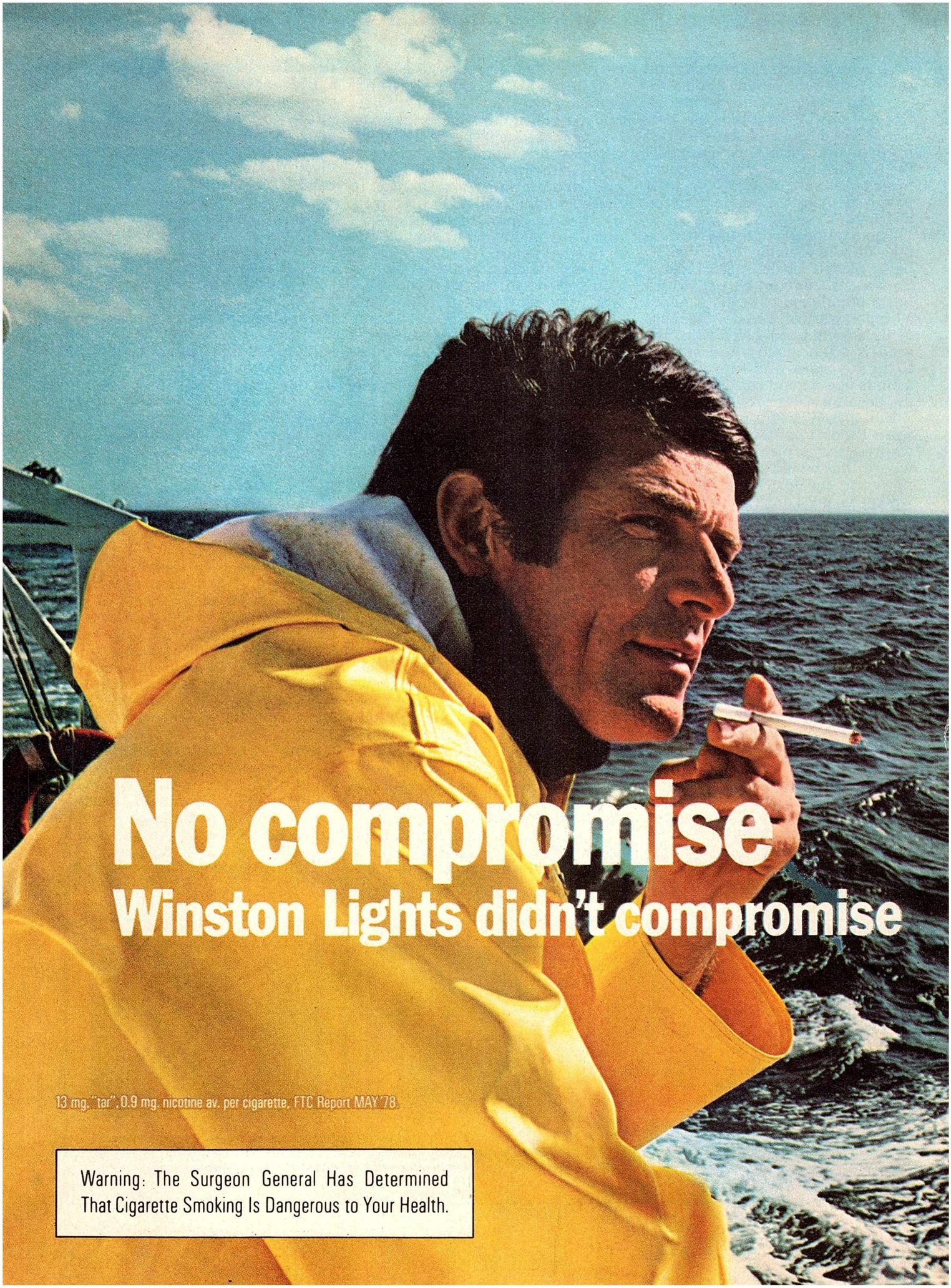
Only time will tell if he's right.●







MODULE racks (left), bolted to ground-anchored concrete blocks, withstand 100-mph winds. Each 3-in. silicon cell (above left) can generate ½W of electricity. Any surplus power is stored in four large batteries (above right).


No compromise
Winston Lights didn't compromise
13 mg. "tar", 0.9 mg. nicotine av. per cigarette, FTC Report MAY '78.
Warning: The Surgeon General Has Determined That Cigarette Smoking Is Dangerous to Your Health.

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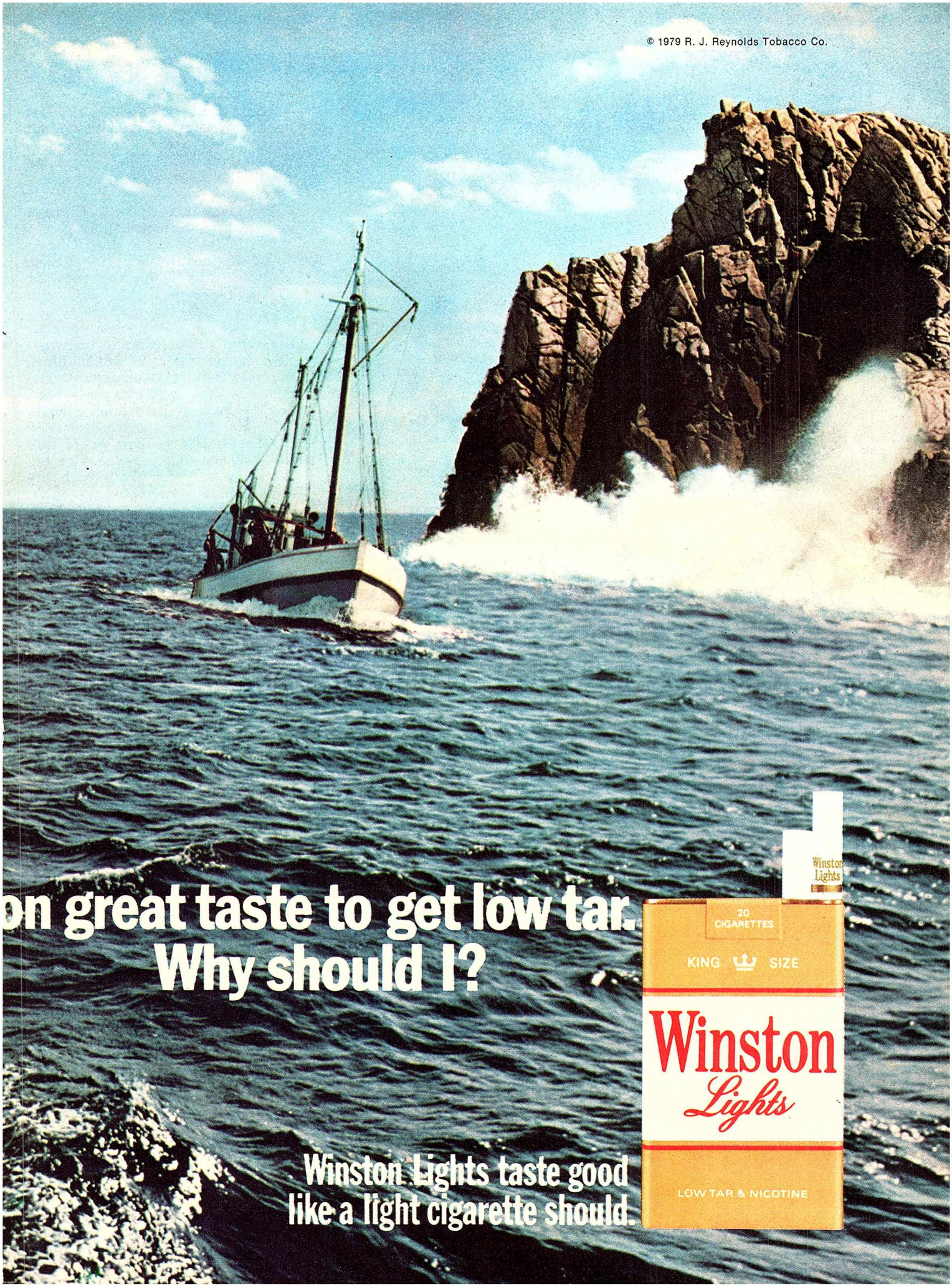


We Try Out a Solo Snowmobile

By Bill D. Miller

CITATION lineup from Ski-Doo is comprised of SS (left), 3500 (center), 4500 (right).

LUXURY feature usually found only on more costly machines is adjustable handlebars.

SAME company that owns Ski-Doo also owns Moto-Ski. The Moto-Ski version of Citation is called Mirage. We drove it also.

SPEED RUN (at 9,300 ft.) on 4500 showed top of 49 mph one way, 48 mph the other.

ZIP-GUN performance marks agile, 1-man rigs.

FOR YEARS, virtually all snowmobiles have been designed to carry two people.

Thus, when we got wind last year that Ski-Doo had come out with a one-man model our ears pricked up. When they expanded the line to three, we had to go for a ride.

The machines are called Citation and feature different horsepower ratings. The SS is top dog. It has a 45-hp engine and sells for $2,250. The 4500 has 40 hp and goes for $1,850. The 3500 is the baby, with 24 horses and a tag of $1,450.

Citations are supposed to bear the same relationship to snowmobiles as sports cars to sedans. Thus, the solo feature is important. The SS and 3500 can't carry a second rider. The seat isn't long enough. The 4500 can because its seat is 10 in. longer. But no one would buy the 4500 for that purpose. The big seat is purely for those with big seats. The fatso special.

When we arrived at the 9,300-ft. level above Jackson, Wyo.—where the rigs were being photographed—we found all three in running condition. But only two—the 3500 and 4500—were set up as they would come from the factory.

Riding these rigs, we recognized two aspects that make them desirable. One is that they offer as standard equipment items that have been luxuries until now. The new Citations have a couple of nifty touches. For one, there's 8 in. of padding in the seat, extra travel in the suspension and adjustable handlebars. And there are racing-type gas caps (spring-loaded, they flip open when you hit them).

The other is zip-gun performance. In general, these little rigs do look sporty—like a TR-7 amongst a bunch of sedans—and, being small, they give you a feeling of going faster than you really are. Not that 50 mph is all that slow.

These machines start with a couple of flicks. Electric start would be wasted. And they proved quite stable on slopes, an important consideration when you're buying a snowmobile.

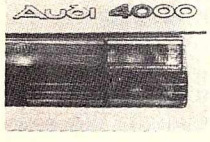
In our speed runs, we clocked a top of 42 mph with the 3500, and the 4500 peaked at 49 mph.

Summing up, these Citations are not for setting speed records or cross-country touring. They are relatively inexpensive, agile, sporty little speed demons that deliver the thrill that basic snowmobiling is all about.●

AUTHOR (left) went to Germany for a meant-for-U.S. Audi 4000. Liked it.

Audi Loses a Fox But Gains a 4000

By Gordon Wilkins
EUROPEAN EDITOR



THERE'S an interesting trend going on in the automotive industry. While the fellows in Detroit are putting in double overtime shifts trying to scale down their cars, the fellows in Europe and Japan are steadily making theirs larger.

The Audi 4000 is a good case in point.

The 4000 isn't totally new. It's really a redesigned, renamed and, yes, enlarged Audi Fox. The 4000 is 8 inches longer, 3 inches wider and 190 pounds heavier than the Fox. That extra size and weight is accounted for partially by 2½ inches more room in the rear passenger compartment and 20 percent thicker doors than the Fox.

These upsized but still small-car features seem to have the American market in mind, and may well have been inspired by some sharp marketing research done by Porsche/Audi. Long before the official announcement date, 100 preproduction cars were shipped to North America for evaluation by Audi dealers and their customers. That included evaluation in conditions from Arizona heat to subzero winter in Canada. As a result, a dozen significant improvements were made to production models destined for North America. They are better equipped and quieter than the European models. They have quad rectangular headlights, instead of two, full wheel trims and U.S. bumpers smoothly blended into the car's basic shape.

That basic shape of the 4000 looks so much like the larger 5000 that I wonder if many people won't buy the less expensive 4000 instead of the 5000. Porsche/Audi figures that, too, and so plans to make the 5000 look a bit more like the 4000 while offering a diesel version of the famous 5-cylinder engine in the 5000. The smooth wedge shape of

(Continued on page 85)

THERE'S a distinct family resemblance between new Audi 4000 and its larger brother, 5000. Cars have same sharp, angular wedge shape for good looks, aerodynamics.

TEST CAR SPECS

Model Tested: Audi 4000
Engine: In-Line Four
Displacement: 97 cu. in.
Net hp: 78 @ 5,500 rpm
Torque: 84.1 ft.-lbs. @ 3,200 rpm
Compression: 8:1
Bore: 3.13 in.
Stroke: 3.15 in.
Wheelbase: 99.5 in.
Length: 176.7 in.
Height: 53.7 in.
Width: 66.2 in.
Min. Road Clearance: 4.6 in.
Front Tread: 55.1 in.
Rear Tread: 55.9 in.
Axle Ratio: 4.11:1
Curb Weight: 2,260 lbs.
Gas Tank Capacity: 15.8 gals.
Turning Circle Diameter: 32.5 ft.
Tire Size: 175/70SR13
Base Price: $7,685
Top Speed: 101 mph

All times recorded on corrected speedometer.

Clinics to Teach The Basics of Cars

By Paul M. Eckstein

TYPICAL car care clinic teaches basics of auto repair to would-be d-i-yers with demonstrations on components, whole cars. This Woolco clinic was in mall near Toronto.

OUR man went to see what can be learned at a clinic, ended up changing filters.

YOU may have noticed how crowded it's getting at the counter of your favorite auto parts store. You might also have noticed that it's getting tougher to find a shade tree to fix your rig under. All the good ones are taken.

With the cost of maintaining the family car getting up to what the Wall Street boys would call exorbitant, ever-increasing numbers of people are taking to doing their own repairs. All sort of people—old folks, women, teenagers. Seems like everyone is trying to save a few greenbacks by doing their own.

But where are all these comelately do-it-yourselfers learning how to fix their cars? Why, only yesterday some of them had never put a hand on a gear, owned but one wrench and had to read the instructions on the bottom of a Coke bottle *(Open Other End)*.

An awful lot of them are being led by the hand through the basics of car care by an excellent type of hand-holder—the car care clinic.

Clinics on basic car care are fast becoming popular. Literally tens of thousands are now being offered in more places than Howard Johnson has flavors, times ten. Many of them are one-day affairs that teach the true basics to people who hardly know a fan belt from an alternator.

PATCHING rusted bodywork is simple stuff, and our clinic showed how simple.

These clinics are not, usually, for those of us who do more with our cars than just drive them. But for the millions of people who don't know any more about cars than where to put the gas but are suddenly developing an interest, these clinics serve a worthwhile purpose. After all, even MI occasionally does the basics.

We checked out one such clinic in, of all places, Mississauga, Ont., near Toronto. The occasion was the first annual Do-It-Yourself Car Care Clinic sponsored by Woolco Automotive Centres of Canada.

The idea of all these clinics is to show people how easy basic car repairs and maintenance is. And at clinics like the Woolco one, that are sponsored by stores, it doesn't hurt if they happen to sell a bunch of car-care products (Woolco is commercial kin to F.W. Woolworth of five & dime fame) at the same time.

So we went to Square One Shopping Mall in Mississauga. We saw that car care clinics do, indeed, teach basic car care.

Before they teach procedures, though, clinics have to teach people not to be afraid to do their own fixups. Believe it or not, many people think of basic car care as a three-headed monster. The best way to get them over that fear is to get them to put their hands on a part and learn by doing. This a clinic can offer.

It's kind of like when you were a kid and Mom used to ask, "How do you know you won't like peas if you don't try them?" You may have *hated* the peas, all right, but you didn't know that until you tasted them. Car care clinics try to get us to eat the peas.

At the Woolco clinic, the first of

(Continued on page 135)

Give any Manhattan the crowning touch.

Seagram's 7 Dry Manhattan.
To 1 part dry vermouth add 3 parts Seagram's 7. Grace with a twist of lemon. Brilliant.

Seagram's 7 Classic Manhattan.
To 1 part sweet vermouth add 3 parts Seagram's 7 and a dash of bitters. Top off with a cherry. Tops!

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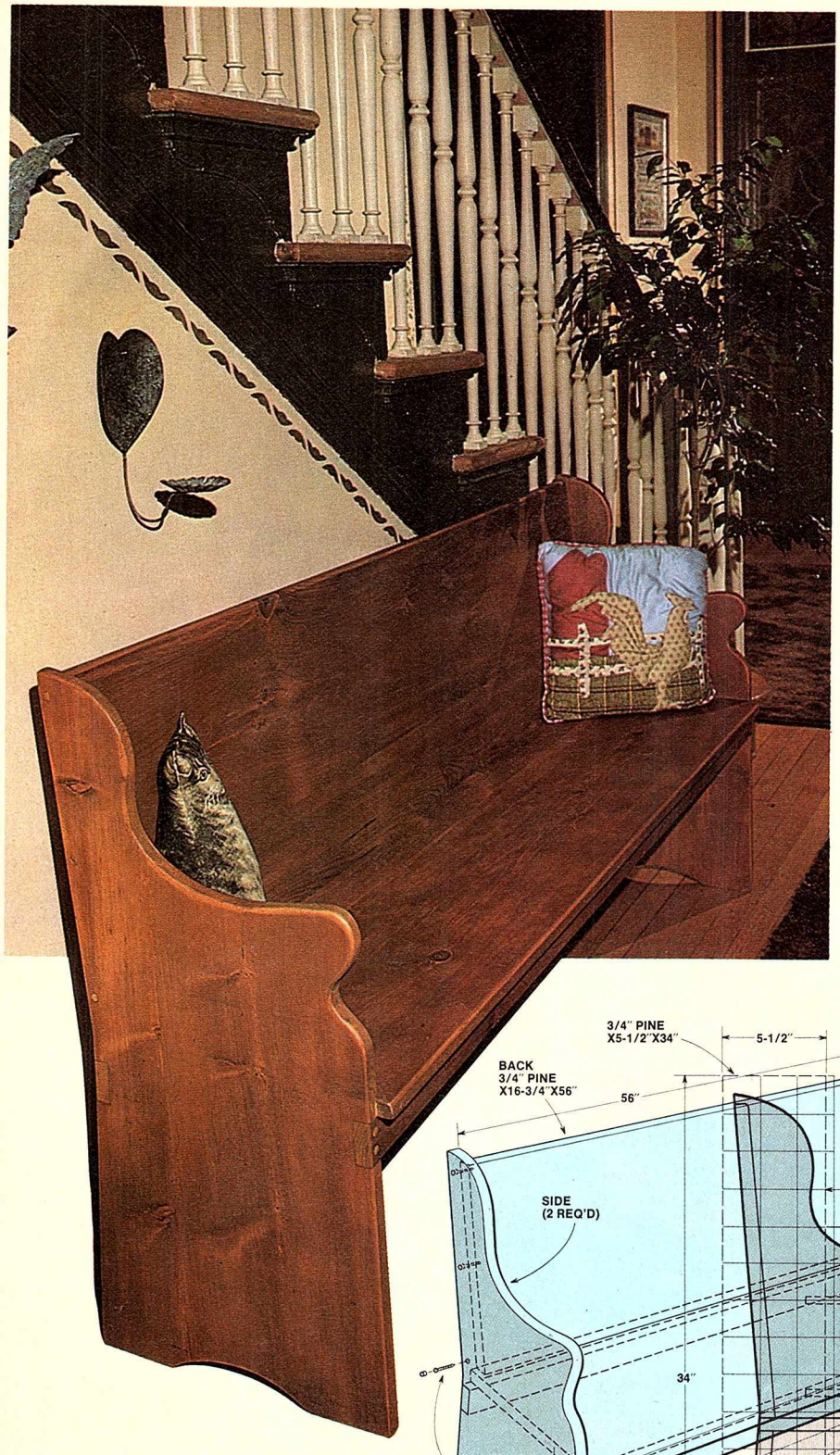
A Bench for Problem Hallways

By Bruce Murphy

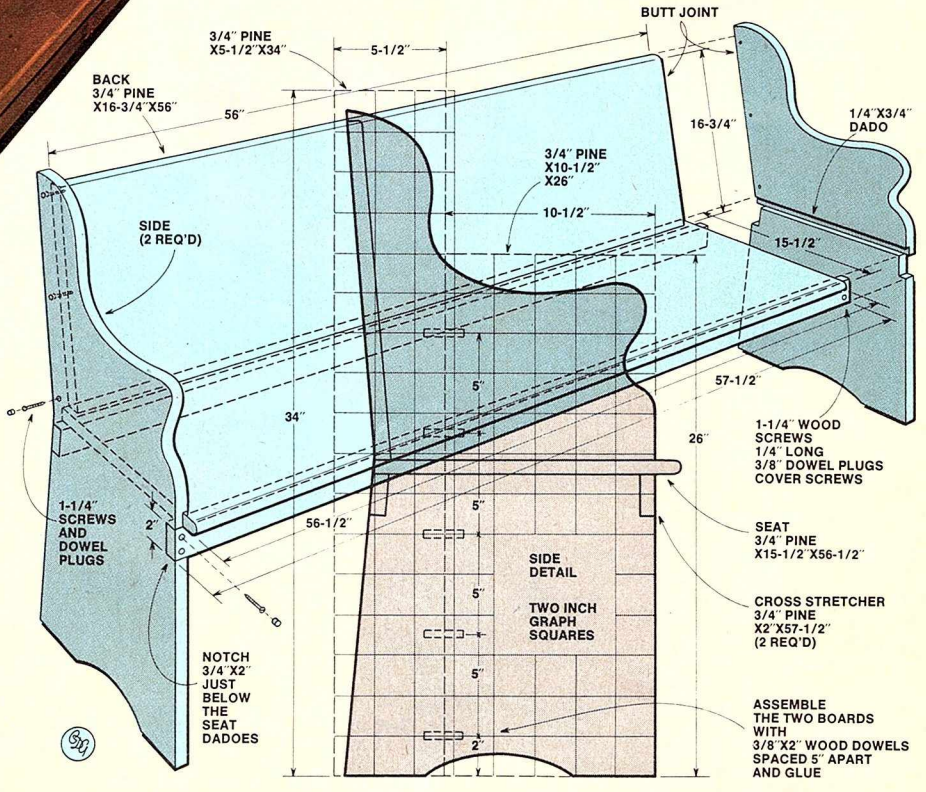
HALLWAYS largely are utilitarian passageways that get you from one room to another. They're not meant to be furnished but, on the other hand, they look pretty grim without something to warm them up.

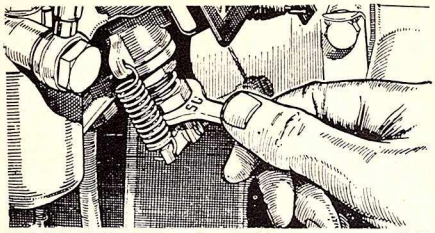
A neat solution to the problem, especially with a long, skinny hallway, is—a long, skinny bench. It adds the warmth of wood and is functional as a place for throwing the mail or for putting on rubbers on rainy days. You also can haul it out into the living room when you need more seating for guests.

You'll like our pine hall bench. It's a classic piece of country furniture with characteristically clean lines. You easily can adapt our plans, too, and shorten or lengthen the bench to scale nicely with any hall problem. We used ours at a stairway/hallway turnaround.



LONG, skinny bench is ideal way to turn problem hallway into not-bad area for guests' coats, putting on winter outerwear. Pine hall bench is a classic piece that can be adapted to any length.





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The bench is made completely out of ¾-in. pine stock. We began by constructing the sides, which are made by joining together one 10½×26-in. board to a 5½×34-in. board with dowels and glue.

Before joining these pieces, be sure to first cut the slanted back on a band saw or saber saw. Save the waste pieces to use as flat filler pieces when you bar-clamp the two side pieces.

The boards are then joined together with ⅜×2-in. dowels and glue and bar-clamped to dry. We used a Record doweling jig to drill the guide holes.

With the side pieces glued up and sized, cut the curved arms on a band saw or saber saw. The ¼×¾-in. dado across the inside edge of each side is cut with a router.

A simple T-square guide made of ½-in. plywood is a great help when cutting dadoes with your router. The T-square guide saves you plenty of time since you don't have to draw a straight line each time you cut a dado.

The bench sides are notched ¾×2 in., just below the seat dadoes, to accept the front and rear stretchers. The stretchers are attached to the sides with 1¼-in. wood screws and glue. The screw heads are countersunk ¼ in. and are covered with ⅜-in. dowels cut flush with the wood surface.

The bench seat is made by doweling and gluing pine stock to size and bar-clamping to dry. At the same time, you also can make the seat back in the same manner.

Before putting the bench parts together, we sanded all of the separate pieces with a belt sander, using fine-grain sandpaper. This is the fastest and easiest way to cover flat areas such as the bench back, seat and sides.

With the two stretchers glued and screwed in place, insert the bench seat into the side dadoes. The seat is edge-glued to the dadoed sides and to the top edges of the front and back stretchers.

With the seat in place, C-clamp it to the stretchers while the glue dries. For extra strength and support, we glued and nailed ¾-in.-sq. glue strips to the bottom edges of the seat along the stretchers and bench sides.

The bench back is the last piece to be put in place. The bottom edge of the back should be beveled to fit flush with the bench seat.

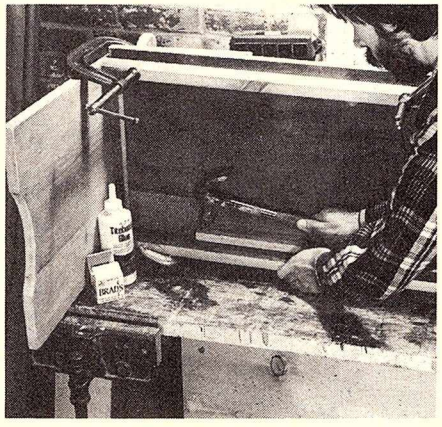
Edge-glue the back sides and bottom first—and then bar-clamp the back in place. With the back clamped, drill holes in the bench sides for the three 1½-in. wood screws that connect each side to the bench back. The screw heads are countersunk ¼ in. and covered with ⅜-in. dowels.

Round off the corners of the bench sides, back and seat. This helps to give the bench the appearance of age and use. The bench now should be given a final hand-sanding before staining.

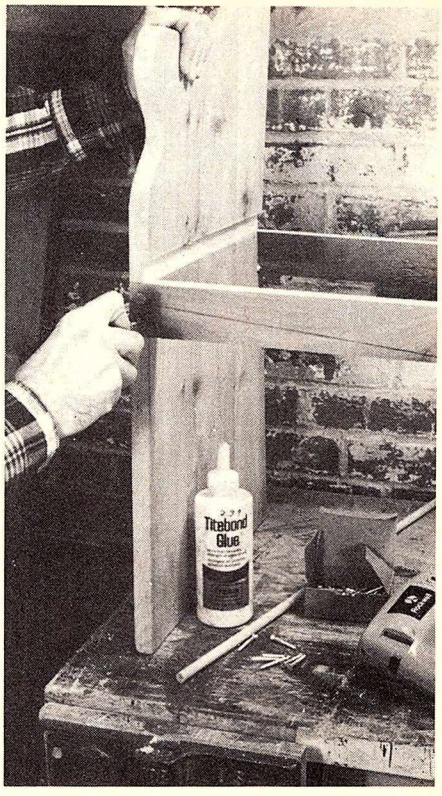
We stained our bench with Minwax Early American. We then applied two hand-rubbed coats of McCloskey's Antique Lustre Urethane, thinned 6 to 1. This final step gave our bench the golden appearance of a fine piece of antique pine furniture.

Your bench should match the decor in *your* house. A bare hallway may be grim, but mismatching furnishings can be grimmer. ●

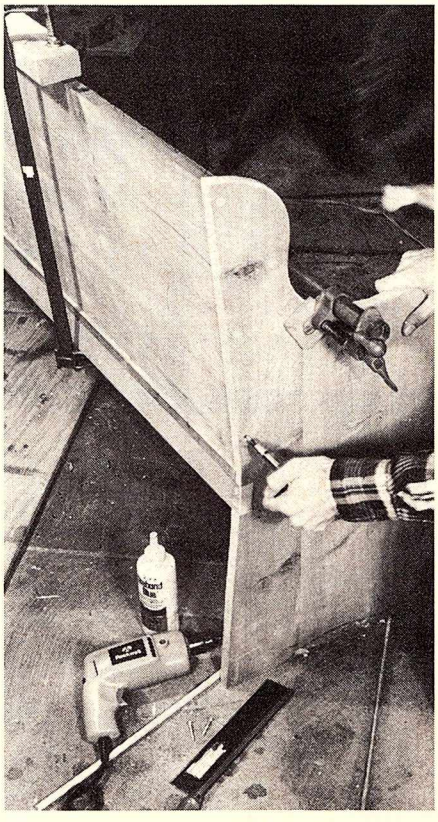
SIDES consist of 2 edge-glued boards cut on a pattern with a saber saw. Dadoes for seat are cut with router and T-guide.



GLUE strips were attached to underside of seat after it was secured with glue and clamped. Strips give extra strength, support.



NOTCHES just below seat dadoes are for 2 stretchers that tie sides, support seat. They're attached with screws, glue.



BACK was glued, positioned and bar-clamped. Three screws were then sunk into each side, into back's edges, plugged.

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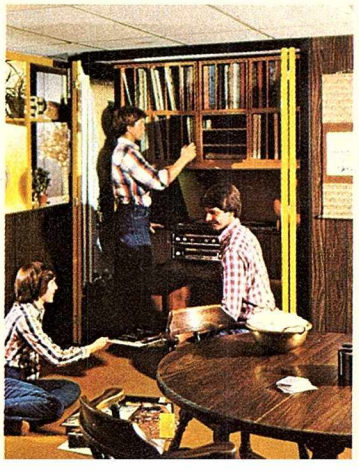
A Do-Your-Own-Thing Basement for Everyone

EVERYBODY has their own space in this do-your-own-thing basement. Only permanent divider (above) conceals two support columns, separates conversation area from gaming area. Soda bar (left) occupies one corner, keeps children together. Adults (below left) have privacy in corner created by movable divider in rear. Beyond divider is folding wall-mounted table for kids' trains or for buffets. Kids (below) use same adult area for listening to music. Wall covering conceals complete stereo entertainment center.



DOING your own thing in your own space in a large family is more often a dream than a reality. What we have here, however, is a very real solution to that problem—a finished basement with something to do for everyone.

Taking raw basement space and finishing it for living, sleeping or parties is not new. But rare is a basement setup that can accommodate the leisure and action of adults and kids at the same time without bugging one or the other.

Rare, too, is the basement that can be changed from a vast open space for big parties to a group of small spaces for one, two or three people doing their own thing. Family and friends can be all together—or together while also separate. It's a great way to handle diversified interests and diverse situations.

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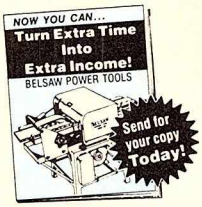

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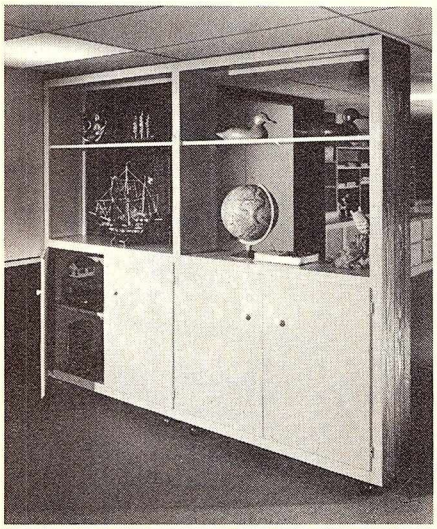
using some of the four exterior walls as special-interest areas *and* making use of movable partition walls. We hasten to add that the partition wall is anything but your usual divider; you can make it a special-interest area, too.

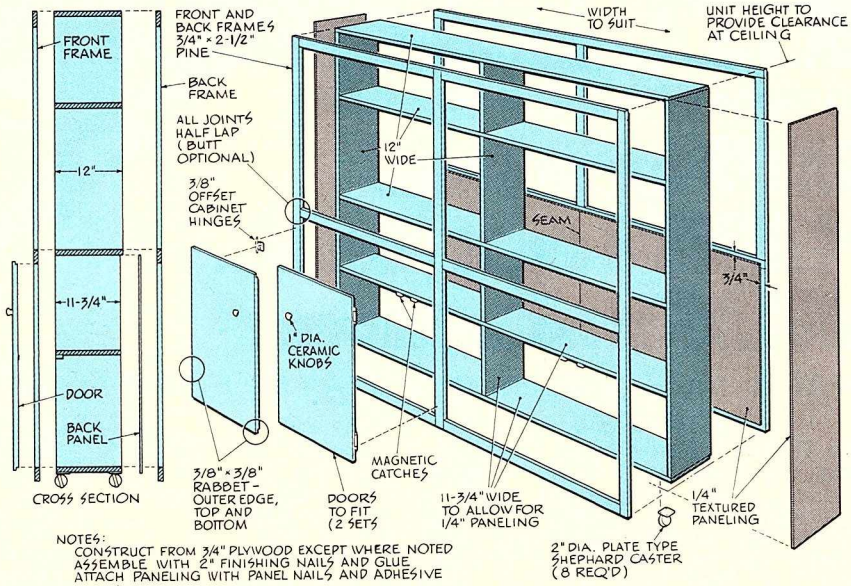
The movable wall is actually structural furniture, although it is faced with wall paneling in order to create the impression of a real wall. It's given further credence by the fact that the low base all but conceals the casters. And it clears the ceiling only by enough space to be moved.

The way this basement centers activities for people is a good starting point for your basement planning. You can adapt or change centers to suit your ideas of leisure, play or study.

There's a traditional conversation area where furniture can be



MOVABLE divider has utilitarian side that consists of ample storage space in lower half. Paneling for this side is optional.


FRONT FRAME
BACK FRAME
FRONT AND BACK FRAMES 3/4" x 2-1/2" PINE
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3/8" OFFSET CABINET HINGES
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DOORS TO FIT (2 SETS)
MAGNETIC CATCHES
WIDTH TO SUIT
UNIT HEIGHT TO PROVIDE CLEARANCE AT CEILING
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SEAM
3/4"
11-3/4" WIDE TO ALLOW FOR 1/4" PANELING
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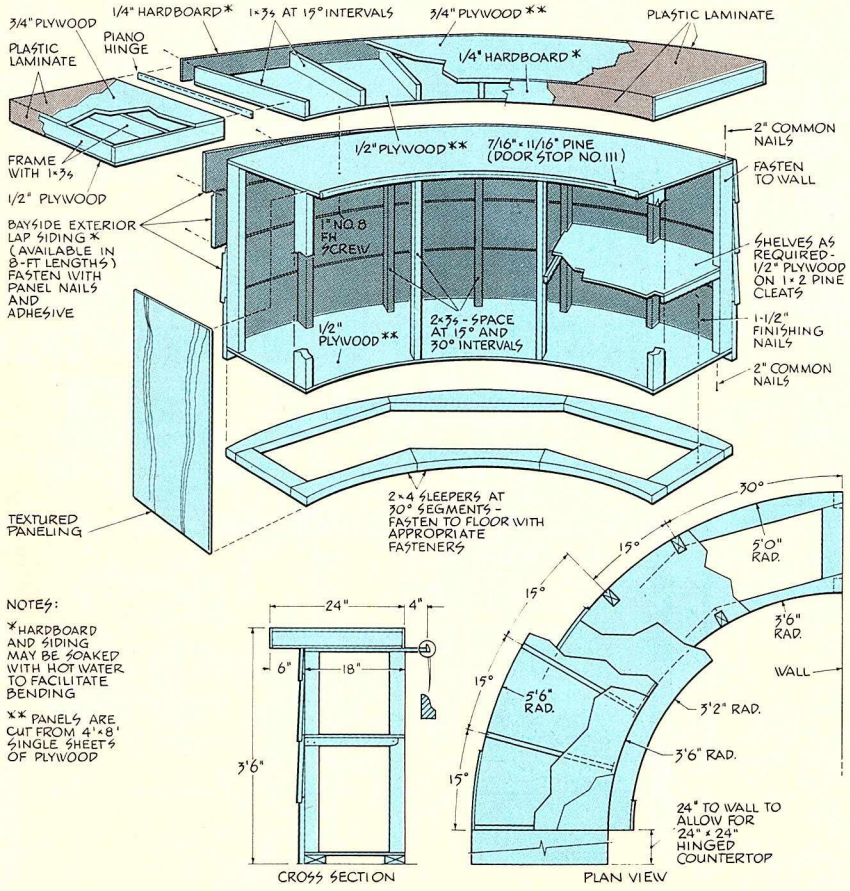
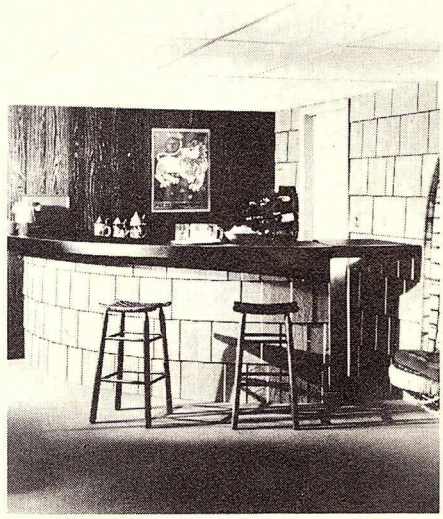




SODA BAR (or wet bar) is curved to accommodate more people on stools in front. Faced with wall material, the top lifts up.

grouped according to the number and positions of partition walls. One corner of the floor area is given over to a billiards table. Another corner has a soda or wet bar.

The walls are something else. Some portions are simply paneled. Others have display shelves, storage cabinetry and a built-in music center. One wall has a large tabletop hinged to it which does double duty as a train table for the kids or as a buffet table for parties.

Paneling the walls and dividers in more than one style also is an advantage; this creates a strong visual difference which helps to segment the areas. Masonite Bayside exterior siding and a woodgrain interior paneling were used in this example.

The floors are covered with indoor-outdoor carpeting. Countertops and shelves are covered with plastic laminate. The ceiling is traditional acoustical tile with recessed lighting.

Your approach to a bare basement slated for finishing should be anything but complicated. While the work itself is indeed one stick at a time, the sticks add up quickly when you have a basic construction plan and follow it to the letter.

Essentially, everything is framing for the structural phase. After that, everything is finishing—whether that finishing is paneling, laminating or whatever.

Framing begins with furring or 2x4s that are anchored to the bare walls. These serve as the nailing or adhesive base for panels and/or for additional framing you may want to build out for cabinetry or fixed partition walls.

Beginning with bare walls also gives you the advantage of fully insulating the basement perimeter—between and over the 2x4s before paneling goes on. You also can set up electrical wiring at this time, whether it's for outlets or for baseboard heaters.

Framing also overcomes real obstacles like support columns. Two of them were framed in and paneled and the fixed box serves as a partition wall. You also can frame in meters and junction boxes.

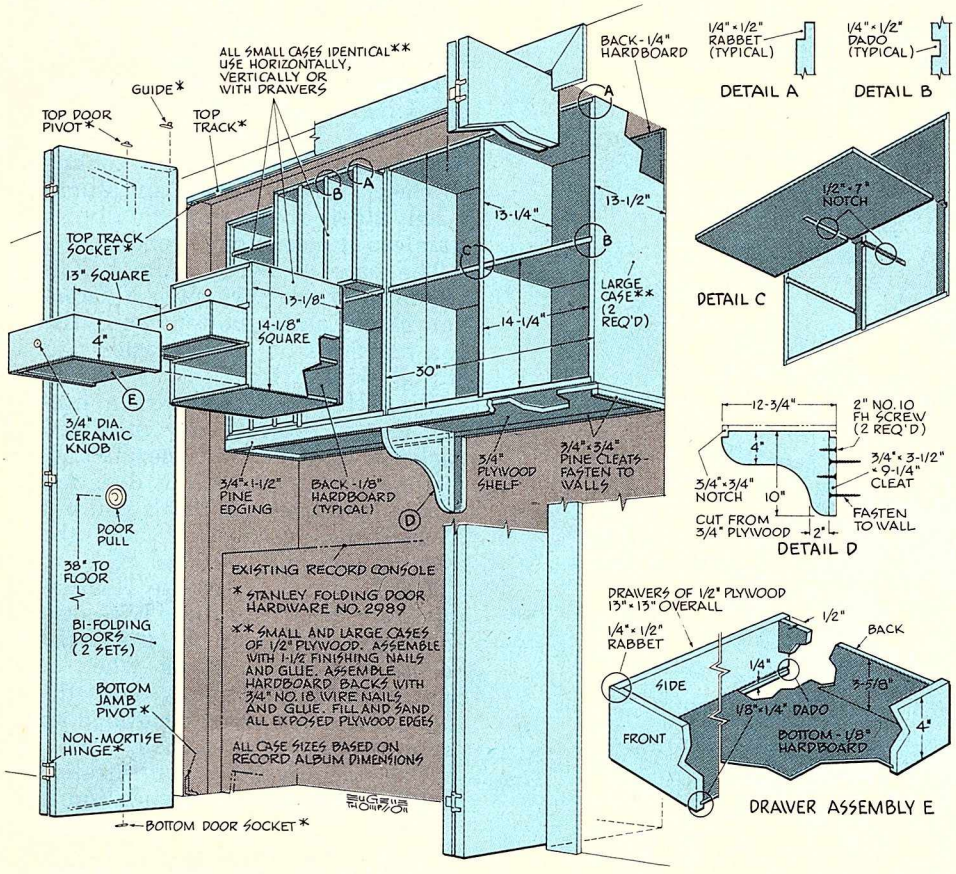
So-called concealed, recessed or closeted areas like the music center are built-out walls with framing lumber or sheet material for shelves, compartments and overheads. Actual furniture, like a stereo credenza or television console, can be made part of the center and will itself look like, at least, a built-in.

The movable partition wall is a free-standing frame-and-sheet structure on casters. The fancy side is sheathed in paneling and the functional or door side is painted. It is a very useful roll-around and you may want to consider wiring it for stereo or using it as a bar or as a buffet. If so, this gives you more wall space for other centers.

The ceiling and floor are the last two elements to be installed. Dropped ceilings of acoustical tile are invaluable in that you can use them for recessed lighting—even for a recessed pull-down projection screen. A lowered ceiling also gives the area a clubby atmosphere.

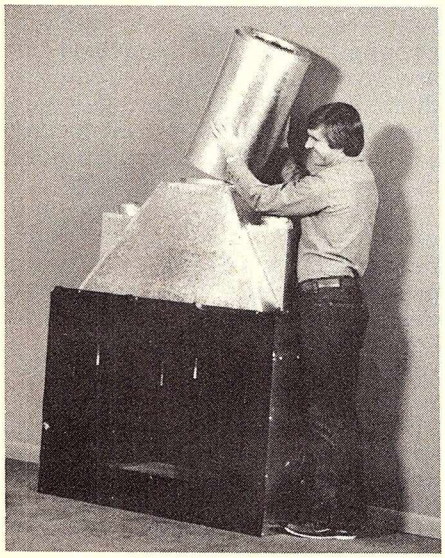
Flooring can be anything you want to install. Indoor-outdoor carpeting has the advantage of being pretty but tough. And a not-bad dance floor. If dampness is a problem, plan for a raised floor (furring strips with a vapor barrier and plywood over) in advance.

Whatever you do in the way of specialized construction details is only frosting on the cake. To make the basic plan work, use the movable partition idea freely—for that's how you build space. ●

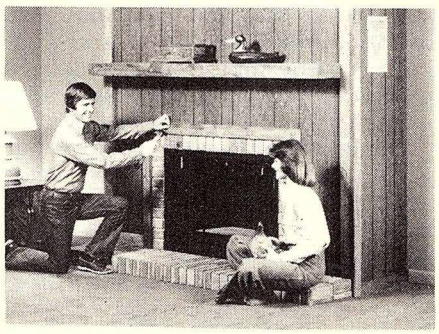


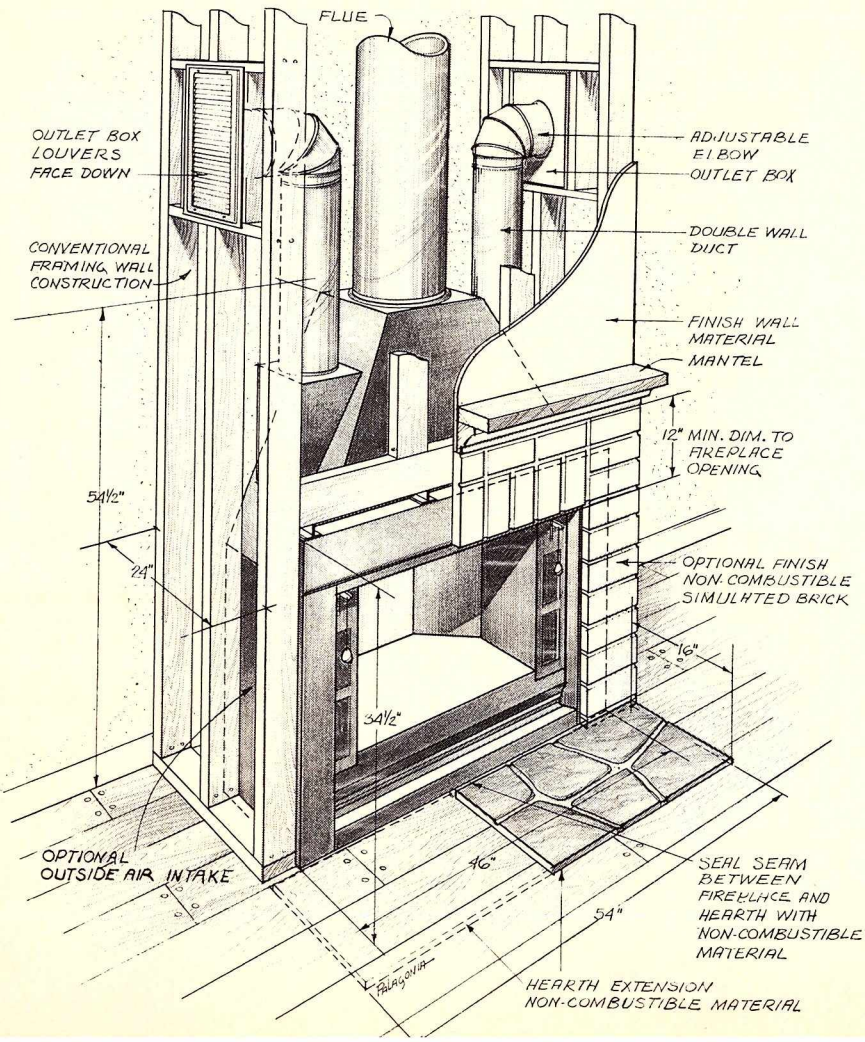
ENTERTAINMENT center is space provided for behind new paneling. It houses all stereo needs, including record collections.

A Fireplace with Zero Clearance?



FACTORY-BUILT fireplace (left) is constructed with 5-in.-thick walls, allowing you to place it directly on a combustible floor, next to a combustible wall. It's called zero clearance. Outer skin remains cool to the touch. One of the flue sections is shown being coupled. You can frame and face fireplace (below) to look like a built-in.





IS THERE a factory-made, built-in fireplace with zero clearance? Yes. You can install it flush on a combustible floor against a combustible wall and not worry about burning the house down.

Unlike free-standing fireplaces and heating stoves which must have 2½ to 3 ft. of clearance from combustible materials, the zero-clearance fireplace is simply set down—just about anywhere you want it. This is possible because of the special construction of the basic fireplace—the walls, floor and linings that surround it.

Zero clearance means the fireplace is self-insulated. The exterior of the basic box remains safely cool while the fire burns. This is the advantage that allows the box to be built into a wall or set against a wall. The same advantage allows you to frame out a false wall in order to create the impression of a built-in fireplace. When completely installed, it can look as if it has been there all the time.

An example of a zero-clearance fireplace is the Heatilator, made by the Heatilator Fireplace Div. of Vega Industries. There are several models of various sizes, but all are built for the same zero-clearance type of installation.

The key to the Heatilator zero-clearance basic fireplace is in the walls. They are 5 in. thick.

There's an outer skin of galvanized metal followed by 1½ in. of rock wool. Then there's an intermediate shell followed by a cooling airspace. Next, there's an aluminized steel shell and, finally, a stainless or refractory firebox.

The base or floor of the box is 1½ in. of refractory plus a radiation shield and a bottom pan. The box itself sits on an insulation pad of high-density fiber.

Thus Heatilator delivers a firebox that is itself a fully insulated package. Installed and operated according to instructions, it does not heat or endanger materials you put it against—nor does it heat the framing you build around it.

The flue system for the Heatilator is not zero-clearance. Like other prefab steel flues, the flue must be fitted with firestops when it passes through ceilings and the roof. And a 2-in. hole clearance all around must be maintained.

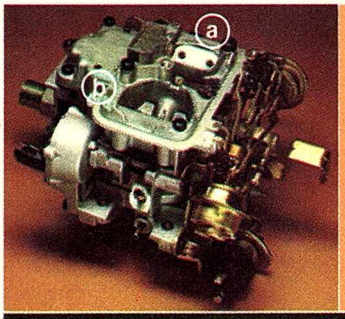
Also like any other self-installed fireplace system, the installation is

(Continued on page 128)

ZERO-CLEARANCE fireplace can be positioned just about anywhere in room, then framed out with 2x4s for decorative facing.

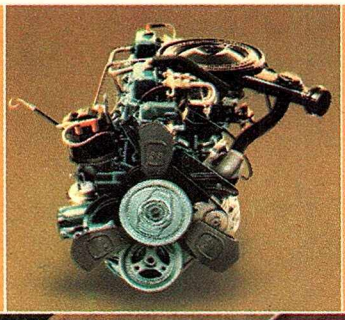
DOUBLE-BARRELED POWER & ECONOMY.

The 4.1 Liter (250 Cu. In.) Six engine has a staged, two-barrel carburetor to help it give impressive horsepower and fuel economy. A plus this year is the new 1980 Chevrolet Three-Year Perforation-From-Corrosion Limited Warranty. See your Chevrolet dealer for details. And ask him about leasing a tough Chevy truck.



STAGED, TWO-BARREL CARBURETOR uses one barrel (a) for normal operation and a second, larger barrel (b) for more power.

DUAL TAKEDOWN EXHAUST MANIFOLD reduces exhaust back pressure. The emissions control system uses engine exhaust manifold vacuum pulses that eliminate an air pump, pulley, belt, and about 15 pounds.



EPA EST. MPG **18** EST. HWY. **24**

Remember: Compare the "estimated MPG" to the "estimated MPG" of other vehicles. You may get different mileage, depending on how fast you drive, weather conditions and trip length. Actual highway mileage will probably be less than the estimated highway fuel economy. Lower in California.

Chevy C10 Fleetside pickup

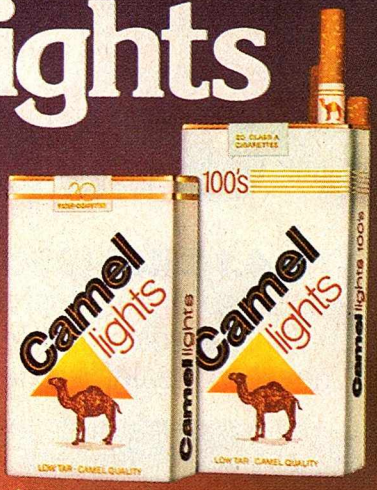
CHEVY TRUCKS

Chevy pickups are equipped with GM-built engines produced by various divisions. See your dealer for details.

BUILT TO STAY TOUGH

© 1979 R. J. REYNOLDS TOBACCO CO.

Discover Camel Lights satisfaction.



The Camel World of satisfaction comes to low tar smoking.

This is where it all started. Camel quality, now in a rich tasting Camel blend for smooth, low tar smoking. Camel Lights brings the solution to taste in low tar.

Warning: The Surgeon General Has Determined That Cigarette Smoking Is Dangerous to Your Health.

LIGHTS: 10 mg. "tar", 0.8 mg. nicotine, LIGHTS 100's: 13 mg. "tar", 1.0 mg. nicotine, av. per cigarette by FTC method.

A Breadbox-Size Navigating System

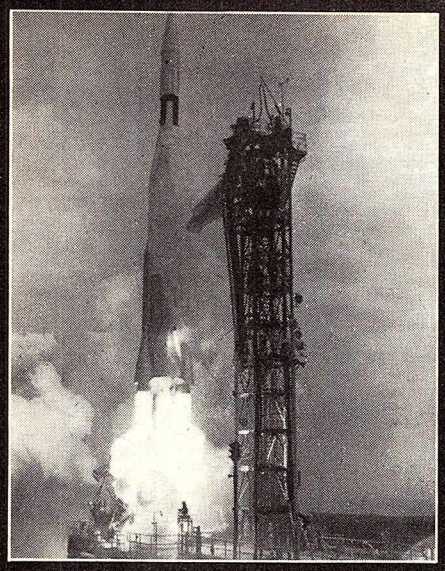
By R. F. Gallagher

WE'RE all navigators to some degree. Navigating is simply finding your way from one place to another and knowing where you are along the way. Usually, though, we think of navigating in terms of ships and planes.

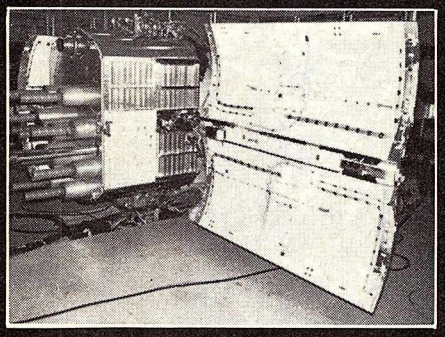
Navigating systems have come a long way since Capt. Bligh's famous 3,600-mi. journey on the South Seas. All he needed was a sextant because all he really wanted to do was get within sight of land. He even might have considered sailing to within miles of a pile of rocks pinpoint navigation.

That kind of accuracy isn't good enough nowadays, of course. And hasn't been for a long time. These days navigating means landing a craft on the moon (some 238,000 mi. away) with an accuracy down to ½ mi. Or orbiting a craft around the planet Jupiter (almost 400 million mi. distant) with accuracy down to 1 mi.

MAJOR SEGMENTS of Navstar navigation system are shown in conceptual drawing. Space segment (satellites) broadcasts position and timing data. User segment (receivers) processes information from four favorably located orbiters to obtain accurate position and velocity components. Control segment (base stations on earth) tracks satellites and updates position coordinates. Our artist has taken some license in locating the Master Control Station and the four monitor stations, all of which are on U.S. territory.

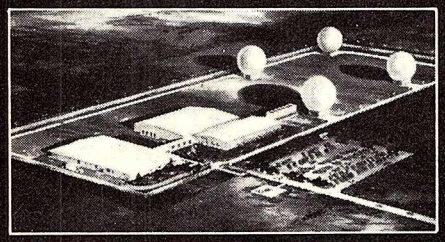


FAMOUS Atlas family of rockets is Navstar's ticket into orbit. Here, rocket boosts Ranger soft moon-lander into space.



MOST of us never see a satellite at such close range. Navstar hardware undergoes test at Rockwell plant in Seal Beach, Calif.

BREADBOX-SIZE navigating system produced by Magnavox is now being tested at Army's Yuma Proving Ground, Yuma, Ariz.



MASTER Control Center at Fortuna AF Station as seen in artist's rendering. Construction is expected to begin in 1980.

You may think that that kind of navigating precision has not much to do with workaday types with both feet on the ground. You may be proved wrong some years down the pike. For the Air Force's Space and Missile Systems Organization (SAMSO) is now developing Navstar, a space-based radio navigation system—global in scope—that could provide precise navigation information by the late 1980s for users throughout the world. (A lightweight backpack model—which could be called *breadbox size*—has been built and is currently being tested for use by ground troops.)

The Global Positioning System (GPS) is a Dept. of Defense project, but the Air Force, Army, Navy and Marines, plus the Defense Mapping Agency, are involved. SAMSO is head honcho, or program manager.

Right now, there are four satellites orbiting the earth, the last of which was launched last December. All have been put up there by the famous Atlas family of rockets. When the project becomes fully operational, possibly in the late 1980s, the Navstar system will include 24 satellites, eight in each of three orbits. This truly artificial galaxy will circle the globe every 24 hrs., all the while beaming continuous navigation signals to earth.

SAMSO is currently working with the Federal Aviation Agency to determine the practicality and long-range use of the Navstar system in aircraft crash avoidance. Present aircraft applications are in strategic defense, with Navstar affording an all-weather, day or night global strike capability.

Another function of the system is to provide navigational fixes for missile and attack submarines which must broach the surface for as short a time as possible to avoid detection. The data received permits the craft to navigate through minefields and to pinpoint location relative to charted buoys, shoals and reefs.

The fully operational Navstar system works like this: All 24 satellites transmit individually coded, 30-sec. navigation messages simultaneously, beginning at the same time and in the same format.

The first 18 sec. contain celestial and clock data. The next segment of 6 sec. is reserved for additional messages. The final 6-sec. portion contains a course almanac for all satellites in the network.

Here on earth, the signals are received by user sets, which can be integrated with aircraft and ships or hand-held by land-based personnel.

The receiver locks onto signals from four favorably located satellites. It then processes the signals and, depending on the information sought, the user can determine his position to within tens of feet, velocity to within a fraction of a mile per hour and the time to within a millionth of a second. This information becomes available quickly with the push of a few buttons—no more difficult than punching numbers on a calculator.

The system consists of three major interlocking segments. The space segment (the orbiting satellites) broadcasts superaccurate position coordinates and timing information. The user segment (receivers) processes this information from the four best-located satellites to obtain accurate position and velocity components. The control segment (base stations on earth) tracks the satellites and continually updates their position coordinates.

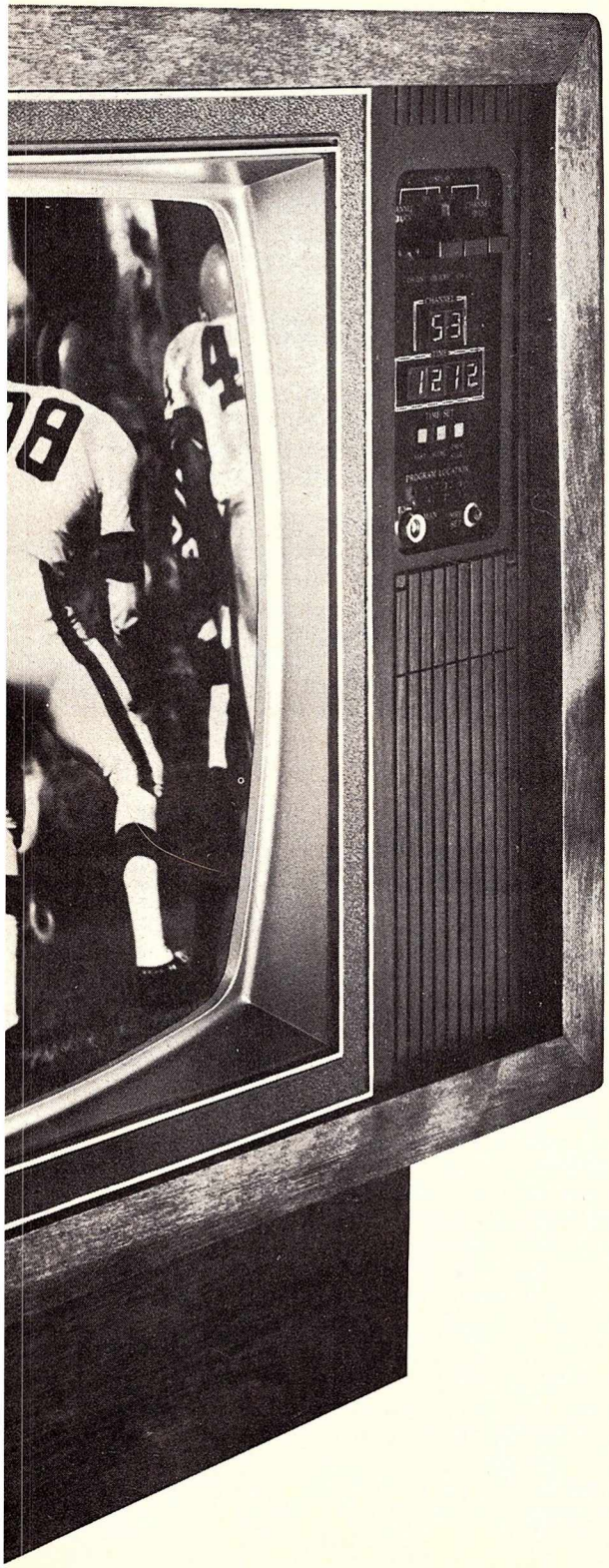
The control segment consists of a Master Control Station located at Fortuna Air Force Station in North Dakota (construction is expected to begin in 1980), plus four monitor stations—in Alaska, Guam, Hawaii and at Vandenberg AFB, Calif. The monitor stations pick up signals from satellites and transmit them to the Master Control Station. These signals are used to determine and correct the errors of each satellite. The corrections are then relayed to the satellites by the Master Control Station.

The satellite itself weighs 1,673 lbs. and measures just 17½ ft. from tip to tip. And, of course, its more than 33,000 parts are a wonderment of sophisticated engineering. For example, the atomic clocks used are so accurate that they gain or lose only 1 sec. in 30,000 yrs.!

The Navstar Global Positioning System, as we hinted, is a little premature for civilian use. But near-future applications involving air, sea and land vehicles abound. They include aircraft runway approaches, photomapping, geodetic surveys, aerial rendezvous and refueling, air traffic control and search & rescue operations.

Further ahead, perhaps commercial fishermen, private-plane pilots, surveyors and offshore oil-drilling outfits might plug in.●

New from NRI! 25" DIAGONAL color TV that tunes by computer, programs an entire evening's entertainment.



Just part of NRI's training in servicing TV, stereo systems, video tape and disc players, car and portable radios.

Only NRI home training prepares you so thoroughly for the next great leap forward in TV and audio...digital systems. Already, top-of-the-line TV's feature digital tuning, computer programming is appearing, and new digital audio recording equipment is about to go on the market.

NRI is the only home study school to give you the actual "hands-on" training you need to handle servicing problems on tomorrow's electronic equipment. Because only NRI includes this designed-for-learning, 25" diagonal color TV with electronic tuning, built-in digital clock, and computer programmer as part of your training. With this advanced feature, you can pre-program an entire evening's entertainment...even key lock it in to control children's viewing.

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The color TV you build as part of NRI's Master Course looks, operates, and performs like the very finest commercial sets. But behind that pretty picture is a unique designed-for-learning chassis. As you assemble it, you perform meaningful experiments. You even introduce defects, troubleshoot and correct them as you would in actual practice. And you end up with a magnificent, big-picture TV with advanced features.

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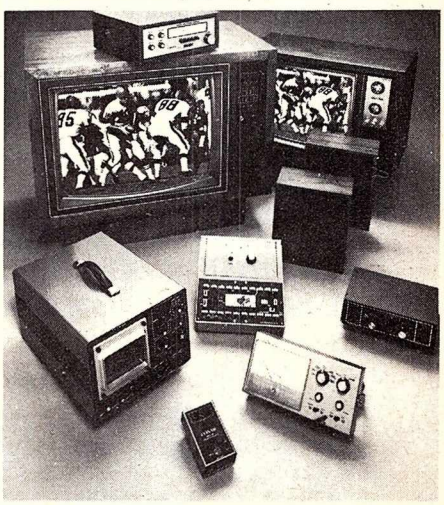

radios, short-wave receivers, PA systems, musical instrument amplifiers, electronic TV games, even video tape recorders and tape or disc video playbacks.

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Mail the postage-paid card today for our free 100-page catalog with color photos of all kits and equipment, complete lesson plans, convenient time payment plans, and information on other electronics courses. You'll also find out about NRI's new Computer Technology Course that includes your personal microcomputer. Or Complete Communications with 2-meter transceiver. If card has been removed, write to:

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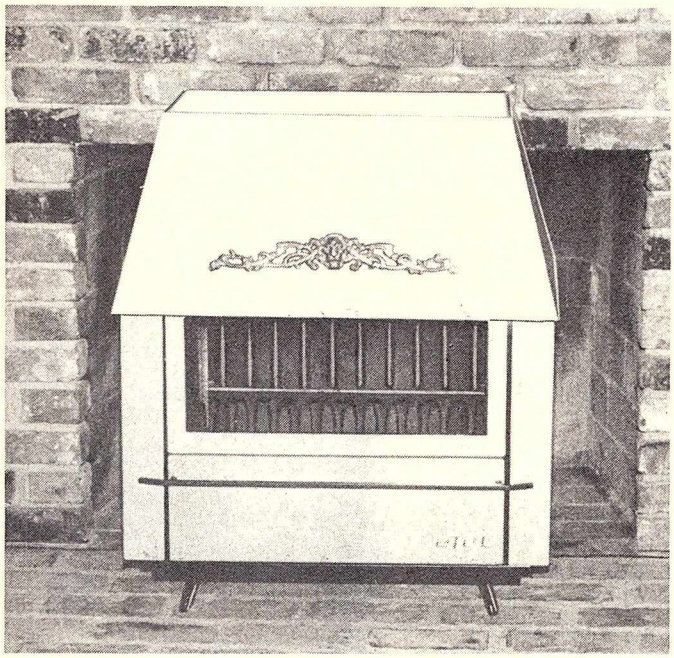
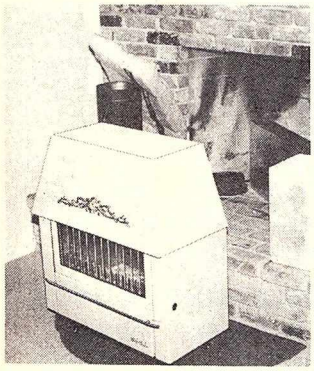
3939 Wisconsin Ave.
Washington, D.C. 20016

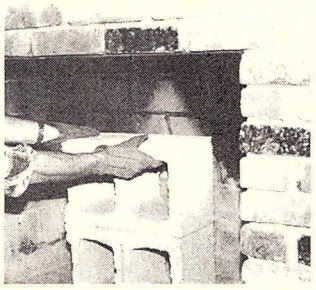
Mating a Stove To a Fireplace

By Charles A. Miller

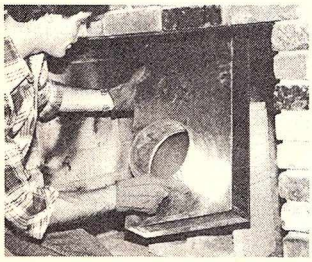




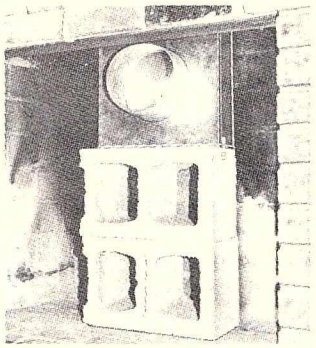
READY to go. Installing a stove is quick, simple job if done with proper equipment.



LOCATE block supports in position on the fireplace floor, directly beneath flue opening.



SLIP damper bypass into the flue opening, making sure the flange is at the proper height.



STRAP bypass to the blocks and tightly seal the damper opening with sheet metal.

WOOD HEAT, in these energy-starved times, is making a comeback in a big way. At one time, America relied almost entirely on wood to warm the house, cook the food and distill the mash. But until recently, the closest any suburbanite came to using wood energy was broiling steaks over hickory chips on balmy afternoons.

Nowadays, wood stoves and other appliances to burn wood are selling by the carload. A recent report from the government put the number sold annually at 1.5 million and bounding.

Along with wood-stove heat, appealing though it may be, comes the problem of adapting the appliance to modern houses, most of which were not built with wood stoves in mind, to put it mildly. There are, however, many homes built with fireplaces, mostly because there's no denying that certain allure of relaxing in front of an open fire—a selling point not lost on homebuilders.

But fireplaces are notorious for the way they waste heat, drawing warm air from a room and shooting it up the flue. In fact, burning a fire in a fireplace can result in a net *loss* of heat from a home.

One way around the problem is to install a wood stove on the hearth in front of the fireplace opening, then seal off the flue and exhaust the stove through the seal. You have to be sure the flue opening on the back of the stove is low enough to permit passage of the stovepipe under the lintel, but otherwise it's a fairly simple job.

One of the easiest ways to handle the installation is with a new device from Wood Heat (Rt. 212, Pleasant Valley, Quakertown, Pa. 18951). It's a bypass that slips up into the flue through the damper opening to which you connect stovepipe extending to the stove's flue connection.

The installation can be finished off in a matter of minutes, with the help of a couple of sturdy neighbors to wrestle the stove into position. What's more, there's no need to destroy the fireplace brickwork with drilling to provide an anchor for straps and the like. Should you wish to remove the stove for the summer or take it with you when you sell the house, the fireplace remains unscathed.

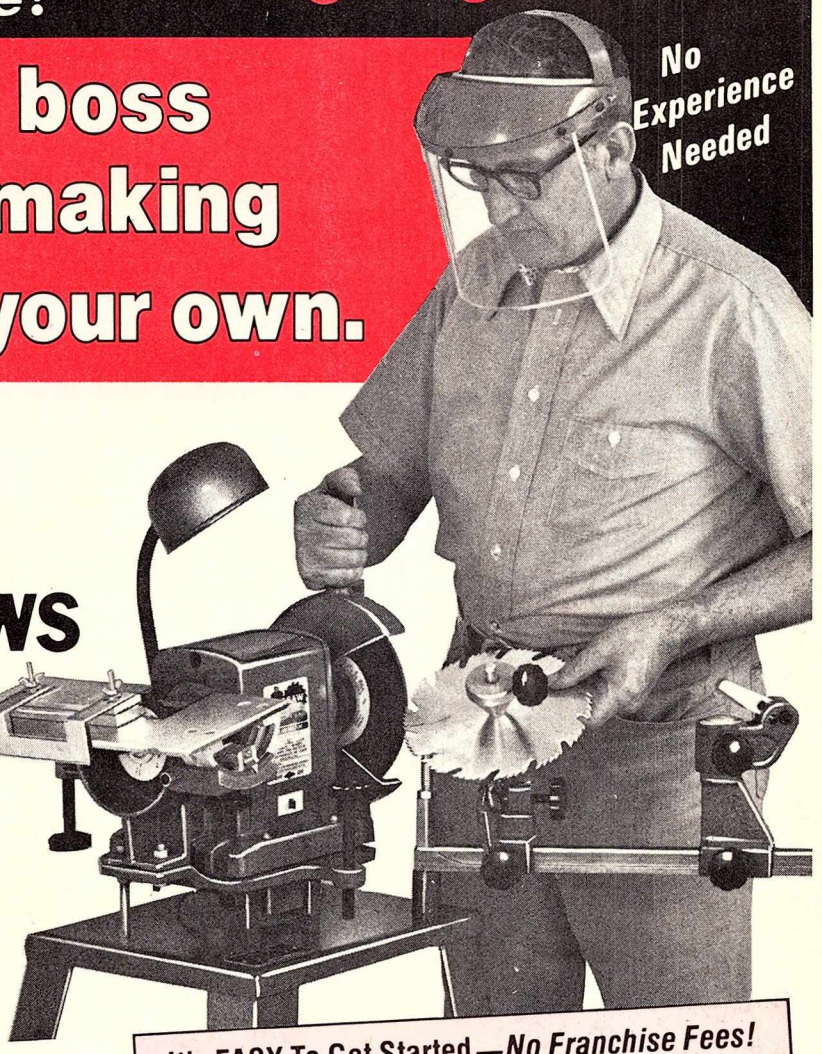
To do the job, you need the damper bypass from Wood Heat, enough stovepipe to reach the stove once it's in place, sheet metal to seal the remainder of the damper opening after inserting the damper bypass, sheet metal screws, concrete blocks, strap metal, furnace cement and, of course, a stove.

Slip the bypass into the flue and strap it with masonry anchors to the blocks. You may have to compensate for different heights by shimming with fireproof material such as asbestos millboard. Just make sure the stovepipe slopes up from the stove to the bypass at an incline of ¼ inch for every foot of run. Next, measure and cut the sheet metal to fit the

(Continued on page 135)

Turn Extra Time Into Extra Income! Earn $5 TO $8 an Hour

Be your own boss in a money-making business of your own.



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garden and shop tools for home and industry

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You don't have to invest thousands of dollars to get started in business for yourself. Low Cost SHARP-ALL and our 45 years of experience in helping sincere men earn extra income, *plus the desire to get ahead* is all you need. Fully illustrated Operators Manual gives clear, step-by-step instructions, shows exactly how to sharpen each tool, where to get business, what to charge, how to get free advertising . . . all the "tricks of the trade". And, SHARP-ALL does the kind of precision job that brings customers back time after time.

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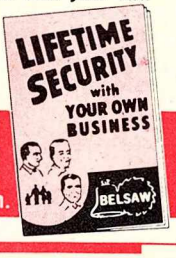

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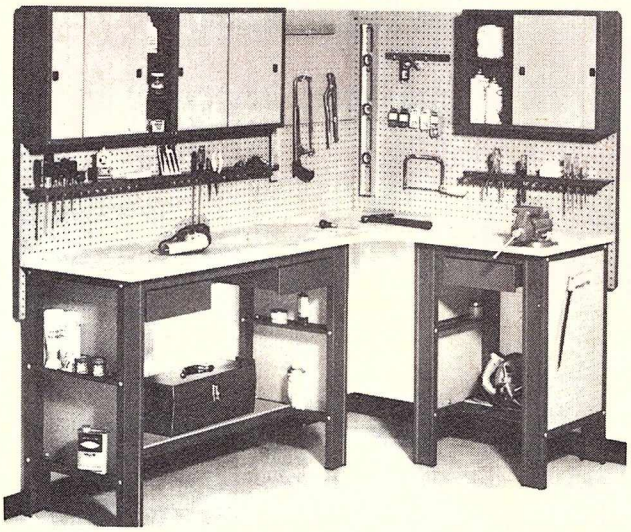
Hardware Store

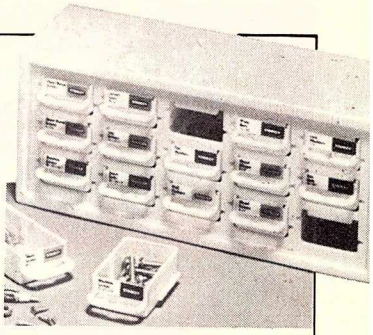
AUTO body filler called Magic Patch adheres to metal, fiberglass. Maker says it resists rust, waterproofs repaired areas. Polyurethane foam spray costs $17.65 for 18 oz. can

Ohio Sealants Inc.,
7249 Commerce Dr.,
Mentor, Ohio 44060



INEXPENSIVE way to organize workshop is provided by Work Centers by Hirsch. They have a particle-board work surface, tool racks with slanted slots for easy tool removal, adjustable shelves and, 3x12x18-in. drawers. There are three models, priced from $25 to $90.

Hirsch Co., 8051 Central Park Av., Skokie, Ill. 60076

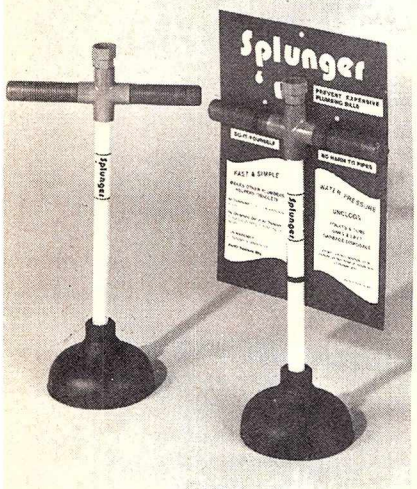


SCREWS, nuts, bolts sold in packs that are also drawers that fit a special storage cabinet. Called The Assembly Line, cabinet, sold separately, is $1.79. Fasteners from 59 cents and up.

The Stanley Works,
New Britain, Conn. 06050

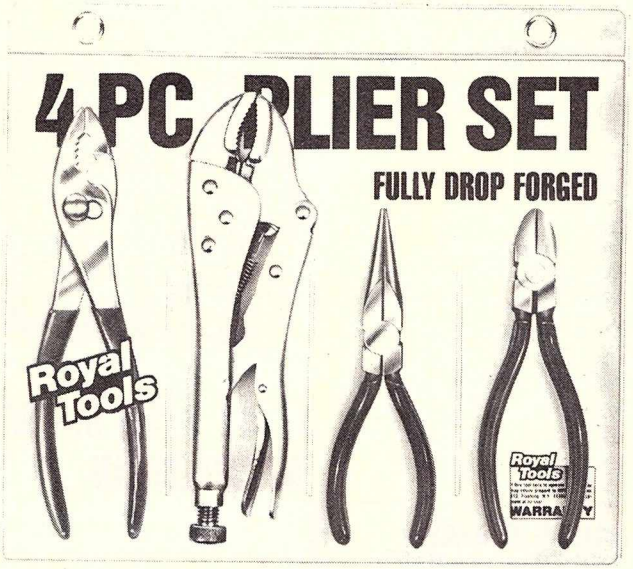
PUMP-SPRAY Fireplace & Hearth Cleaner removes dirt, soot and water stains from brick, marble, fieldstone, slate or any other hard surface. $2.89 for 32 oz.

Butcher Polish Co.,
Bartlett St.,
Marlborough, Mass. 01752



WATER-PRESSURE plunger connects easily to garden hose. Called Splunger, it exerts up to 70 lbs. of controllable pressure to clear clogged drains. $7.99.

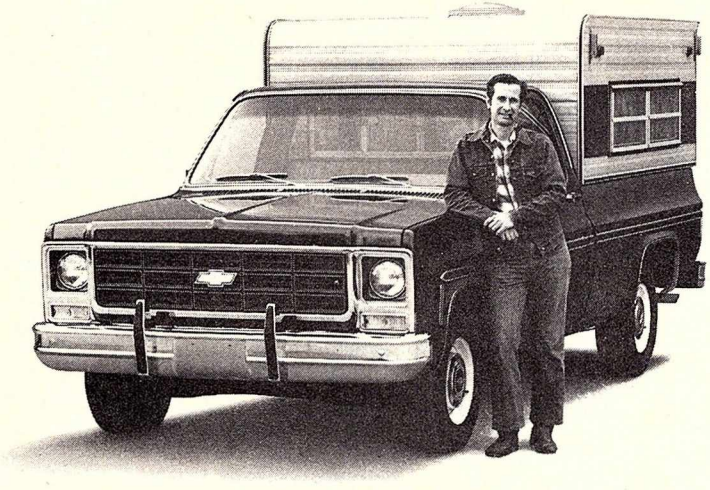
Pacific Hardware Mfg.,
184 Old County Rd.,
Belmont, Calif. 94002



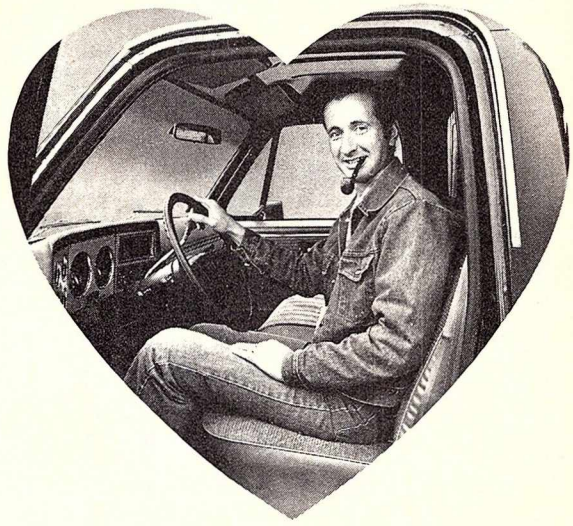
PORTABLE hand-tool kits are available from Royal Tools come in vinyl pouches. Among the 10 assortments are vise and adjustable wrenches, pliers, screwdrivers and open-end combination wrench sets. Priced from $12.

Royal Tools, 13-15 131st St., College Point, N.Y. 11356

If you like a Chevy Pickup,



you'll love it with Tilt-Wheel.



"Tilt-Wheel's really great in my Chevy pickup!"
Larry B. Malles
Fort Wayne, Indiana

Tilt-Wheel is available on all GM light-duty pickup trucks. Tilt-Wheel means easy in and easy out. And, it helps fit the truck to you. You can put the wheel where you like it for driving. Tilt-Wheel makes a big difference for a small price. Ask for a demonstration, the next time you go to buy a GM pickup.

Saginaw GM
Saginaw Steering Gear Division

ASK MI

FEBRUARY's here again. Luckily it's a short month because it's that strange time of year when the weather's bleak, the football season's over and the baseball season has yet to begin. So, lots of folks find themselves sitting around with nothing to do. This makes it the perfect month to take on a home-improvement project—like the fellow in our first letter, who's redecorating his townhouse.

I've been redecorating our old townhouse and have a problem. The old Victorian plaster took quite a beating during a period when the place was a rooming house. I have repaired it in most rooms and papered over it. In the top-floor rooms I have been repairing plaster extensively and then covering with painter's liner (a fine canvas) before painting. But in the plastered shaft under the skylight the liner bubbles up long after the paste has dried. It does this repeatedly. What can I do?

James Reedy
Brooklyn, N.Y.

You get much more sun and heat in that location than on other walls and that causes the bubbling. Make a cut in the bubbles, squirt some glue in and press down the material. This should solve your problem. But if the bubbling persists, use another material—thin composition board or Foamcore—to cover the old plaster. Cut and glue it to fit and then get on with your redecorating.

A woman friend who has coffee with me always dumps the leftover coffee down the toilet. She says it's a plumber's secret, like putting oatmeal in the boiler of a furnace. Is there anything to this? Don't print my name or address. I wouldn't want her to think I was checking up on her.

Name withheld

The trick plumbers use is to put coffee in the tank of a toilet. Perk, drip, instant, espresso, decaffeinated—makes no difference as long as it's black coffee. If the coffee darkens the water in the bowl, you know you have a leaky flush valve.

You didn't ask me, but putting oatmeal into the boiler was beneficial only if there was a small crack in the boiler. The meal would flow into the crack and cook hard, like oatmeal in a cooking pan.

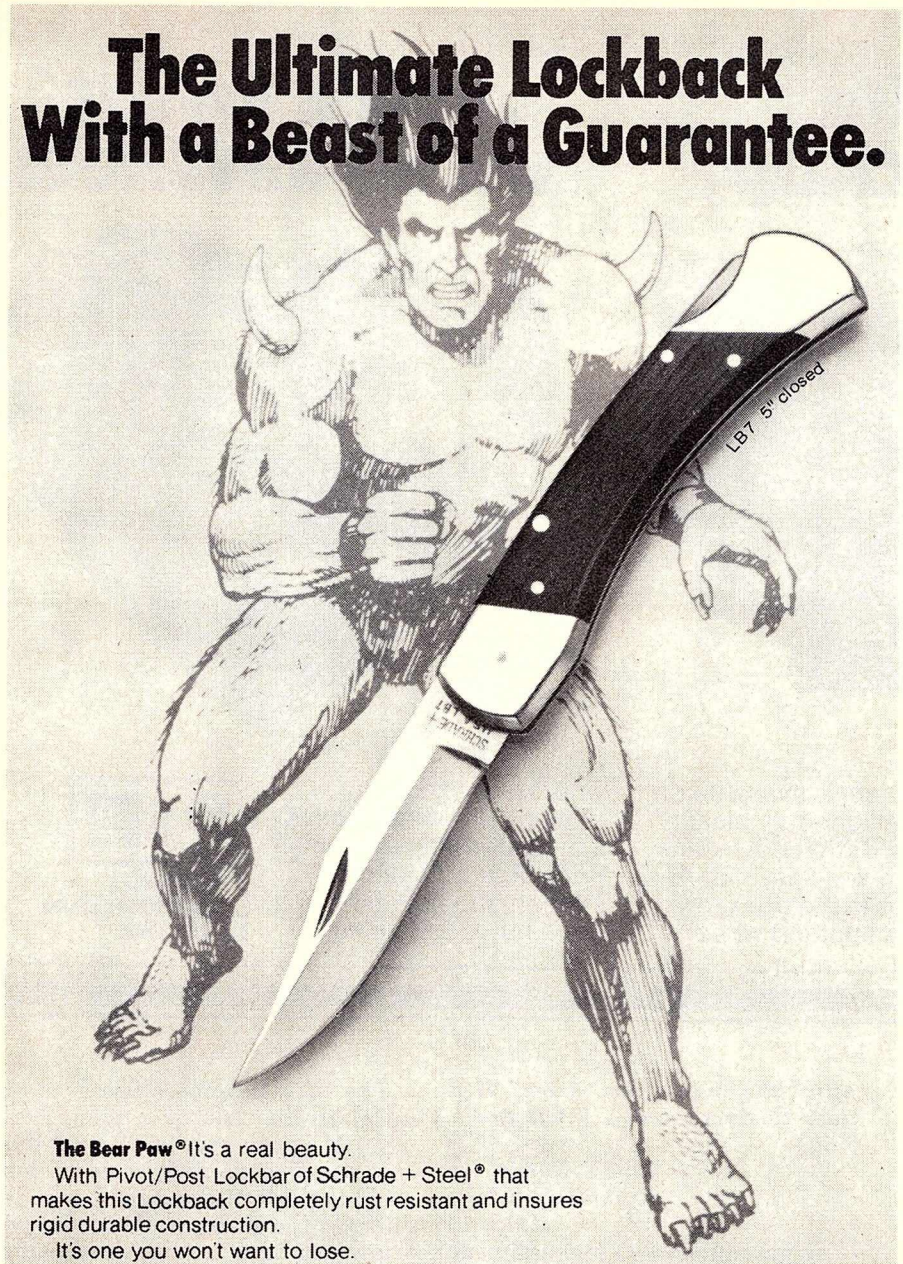
I'm about to replace the worn sash cord in one of my windows. Before I do, I'd like to know which is better, chain or cord? And what else can I do to the window while I have it apart?

J.R. Prouty
Skowhegan, Me.

Chain is better. The cotton cord is good for years but dries out and gets brittle in time.

As long as you have the window out of the frame—you do have a storm window in there, in Skow-

The Ultimate Lockback With a Beast of a Guarantee.



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Ask MI

hegan in cold weather?—you can dig out all the dried glazing compound or putty (I hope it isn't that old white lead material, harder than most kinds of heck) and replace it with new compound. Sand the paintable part of the sash and repaint it. Either oil the track or cover it with a thin coat of paint. Replace all the cord, not just the one that has parted.

One of the drawers in an antique chest I own says "Oh!" when I push the drawer back in. I am not exaggerating. It doesn't just suggest the idea of somebody complaining. It literally makes the sound of a sad tenor voice saying "Oh!" as if I were hurting it. Would there be TV interest in this?

Tom Beck
Congers, N.Y.

Offhand, it sounds too good for television. What you describe is an interesting accident, but this sort of thing has been done on purpose. The Italians make these little songbird callers out of wood so that one part rubbing on the other sounds like a songbird trilling. In Japan they used to make furniture that produced a kind of squeak, like a mouse caught in a meat grinder, that charmed the Oriental music lover. They'd open and shut drawers when they had no need to, just to hear it. If you want to ruin this effect, take out the drawer, turn it over and rub some soap on the runners.

I would like to put one of those flat, upright mailboxes next to my front door. How would I go about attaching one to a brick house?

Mary Killian
Tacoma, Wash.

In the back of the mailbox there are holes for screws. Put the box up against the brick in the spot where you want it and mark the holes on the brick with a soft pencil. Measure the screws you are going to use (about ¾ inch). With a masonry bit, drill holes into the brick as indicated by the pencil marks. Make the holes a little deeper than the screws require—a ⅜-inch bit should do the job. Find a dowel or whittle a piece of wood. Split it down the middle, drive it into the holes and trim off excess. Now you can attach the mailbox, screwing into the split dowels, which will expand tightly in the holes.

Will adding linseed oil to regular exterior paint make it serviceable as a primer? What about applying plain linseed oil to bare exterior wood?

Roger Tillman
Toledo, Ohio

Both things you mention are done to condition wood before coating it with oil-base paint. The paint makers want you to buy their made-up primer and they say they put things into it that do much more than get some oil into the wood. Old-timers say putting oil in the paint or oiling the wood first is just as good . . . and costs less. My policy is to use up leftover paint the best I can. So, sometimes I'll use primer; other times I pour in the oil. I favor oiling very old, dried-out exposed wood pretty liberally.●

"Chess Challenger-10 Wins Microchess Tourney"
—Personal Computing Magazine
February, 1979

Genius Offspring

"Its successor, the new Chess Challenger-7, is infinitely more powerful."
—S. Samole
President, Fidelity Electronics

JUST RELEASED
VOICE CHALLENGER

Chess Challenger-10 did more than win the Penrod Memorial Microchess Tournament, it literally trounced all opponents. Personal Computing Magazine, February, 1979, reports, *"Chess Challenger-10 emerged as the easy victor with ten wins, two draws and no losses."*

All Top Name Performers

There were no amateurs in the championship playoff. Every contender bore the brand of a well-known electronic chess game, and each was accompanied by its entourage of coaches, programmers, and engineers. After each contestant had played all of the opponents in round robin fashion, the brilliant Challenger-10, stood far ahead of its second place runner-up.

Nobody Knew

Unknown to the other companies, the undefeated tournament leader was being retired after the contest. Taking its place was a far more powerful chess computer, the Challenger "7." This new micro-computer had already beaten the official undefeated champ during a series of pre-tournament warm-up games at the factory. Its engineers explain that it is simply 14 months ahead in technology, in finer algorithm sophistication and in its superb performance.

Improve Your Game to Near Brilliant

Within its seven different levels of play, you can enjoy every degree of chess competition, from beginner to tournament skill. Its total flexibility lets you change games midstream or switch sides with the computer to see how it would handle your dilemma. You can add pieces to your side or take away the computer's Queen. It is a superb teacher!

Touch the PV key and the "7's" total recall memory will verify every piece position on the board. You can even set up hypothetical encounters to test its reaction at each level.

Fidelity's Challenger "7" is able to analyze over 3,024,000 board positions. It masterfully handles over one thousand book openings and will respond to any deviation. Academic openings as Sicilian, French, Ruy Lopez and Queen Gambit Declined, are just some of the challenges to keep you on your toes.

It Knows Every Rule in the Book

The Challenger "7" will permit you to castle or perform an En Passant capture or do so itself, if that is its best move. When your pawn has reached the eighth rank, it will be automatically raised to a Queen, unless you tell the computer to promote it to another piece. It will take on any player and sharpen his skills considerably...but it won't permit illegal moves.

At Level 1, its average response time is 5 seconds. At Tournament Level 7, the Challenger makes championship decisions in just 3 minutes.

Unbeatable in Price As Well As Play

Best of all, the Chess Challenger "7" is just $89.95 complete with chessmen and UL approved 110V AC adaptor.

All pieces are magnetized, to stay where you place them on the permanent metal board. The set is mounted in a simulated wood-grained housing which measures 12⅛" x 8" x 1." Bright, one-half inch tall LED electronic digits, provide unmistakably clear readout.

Final Results

Reprinted Courtesy of Personal Computing, February, 1979. P. 66. (Darker lines ours.)

	CONTESTANTS		OPPONENTS 1	2	3	4	5	6	7	8	9	Games Won	Drawn	Lost	FINAL SCORE	FINAL POS.
1	MICRO-CHESS 1.0 (Heath H-8)	W		½	0	1	0	0	0			1	3	8	2½	7*
		B		½	½	0	0	0	0							
2	MICRO-CHESS 1.5 (TRS-80)	W	½		½	½	0	0	0			0	5	7	2½	6*
		B	½		0	0	0	½	0							
3	MICRO-CHESS 2.0 (PET)	W	½	1		1	0	0	½			3	4	5	5	4
		B	1	½		½	0	0	0							
4	CHESS CHALLENGER (3 Level)	W	1	1	½		0	½	½			2	5	5	4½	5
		B	0	½	0		0	0	½							
5	CHESS CHALLENGER (10 Level)	W	1	1	1	1		1	½			10	2	0	11	1
		B	1	1	1	1		1	½							
6	BORIS	W	1	½	1	1	0		1			7	2	3	8	3
		B	1	1	1	½	0		0							
7	SARGON 1 (TRS-80)	W	1	1	1	½	½	1				6	5	1	8½	2
		B	1	1	½	½	½	0								
8	ATARI *Did not play*	W														
		B														

*Note: Microchess 1.5 wins 6th place over Microchess 1.0 by virtue of the tie-breaking analysis of relative strength of opponents

A MAJOR ADVANCE
VOICE CHESS

Brand new from Fidelity—the granddaddy of them all. VOICE CHALLENGER. It may look something like the "7," but it's a great deal more. Increased microprocessor brain offers all of the 7's ability plus three additional levels beyond the seven: *Excellent* (6 minutes), *Expert* (11 minutes) and *Infinite* (from 5 seconds to days). But, you needn't wait days. You can command this level to move at any time. So many readers have asked for *maximum skill.* This is it.

Most incredible, it *TALKS.* In addition to its display, an electronic miracle of voice synthesis permits this phenomenal Challenger to speak. It's not a tape, but a computer-created voice distinctively announces each move it makes. It verbalizes your moves, too. It has a vocabulary of over 50 words which will also suggest a move for you if you take too long.

If the Voice Challenger is about to set up a mate-in-two offense, it will flash, "Mate-in-Two." From here on, you'd better be a whiz to avoid defeat. This set (same size as "7") comes in a black enamelled hardwood cabinet. Hand-carved Staunton pieces in tan and black are magnetized to stay put. The unit is complete with a durable ABS carrying case.

Both units are backed by a 90-day manufacturer's limited parts and labor warranty.

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Quick Midwinter Siding Repairs

By Rosario Capotosto

IT'S THE PEAK of winter and it looks like the weather has been feeding on your home's shingle siding. You know it'll cost you in the long run if you don't repair—because when weather gets inside, sheathing rots and looks shabby.

Relax. Fixing it yourself is easier than it looks.

Hoarding shingles in the basement is a good idea for these occasions. If there are none down there, it's unlikely that you can buy just a few shingles. Probably you'll have to get a square or broken square. But the spares will come in handy next time.

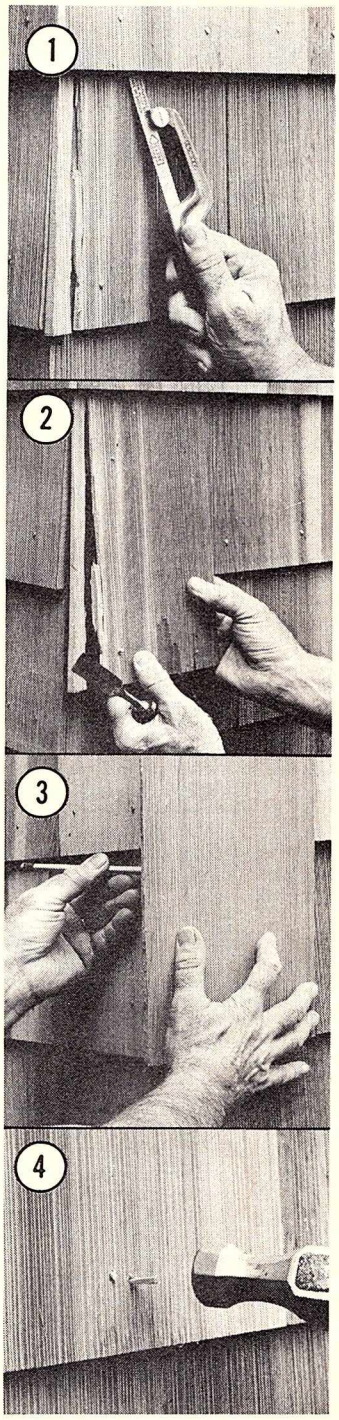
Wooden shingles are good for many styles of homes. In Cape Cods or Colonials, you can paint or stain shingles. For ranch or contemporary designs, a wide expanse of shingles often adds a desired effect. They're easily stained and provide a long-lasting finish.

You can get wooden shingles in three standard lengths: 16, 18 and 24 in. The 16-in. length is probably the most popular. Four bundles cover 100 sq. ft. of wall.

Nonwood materials, such as asbestos, are often selected for siding because they don't need much maintenance. But developments by the paint industry are resulting in comparable long-life coatings for wood-base materials.

Here are two typical shingle-siding repair methods—one using wood, the other, asbestos. All you need are some shingles and nails, a claw hammer and a drill.

The procedure is almost the same for both wood and asbestos. Shingle removal and replacement make the difference. Asbestos



THE first step in removing a damaged wooden shingle is to free it from the course above by cutting the nails (1). Then, pull it down (2). Holding the new shingle in place (3), trace the cutting outline. Secure it with galvanized siding nails to prevent rust and stains. You can use wooden pegs (4) to seal the old nail holes in the upper shingle. From there on, you're home safe with the replacement.

shingles are brittle, so take care not to shatter adjoining, undamaged ones. Depending on the shingle, you use either asbestos or wood nails—both galvanized. Just locate those battered shingles and you're ready to begin.

Asbestos shingles are secured with two or three nails, depending on length. Unlike wooden shingles, nails driven through asbestos shingles don't penetrate the edge of the previous course. So removal isn't complicated—just go easy.

If the damaged asbestos shingle is not at a corner, first fit a knife blade below the edge. Pry the nails up slightly and pull them out with a claw hammer. The nails should come out in a jiffy if the sheathing is insulation board. For sheathing of solid wood or plywood, you may have to cut through the nails with a hacksaw blade.

Corner shingles are locked in by a channel of metal molding and the upper, overlapping shingle. Some shingle experts tell you to splinter the shingle with a hammer. Don't try it, though; you might damage the molding or the waterproof building paper behind it.

Instead, pry the nails loose on both the damaged corner shingle and the one above it. Use a wad of paper to prop out the good shingle's bottom edge. Now you can pull the damaged shingle sideways to clear the corner molding, then down and out.

Subtract ⅛ in. from the distance between the inside edge of the corner molding and the adjacent shingle. And cut the new shingle to size with a saber saw or handsaw.

With the upper shingle still propped out, work the replacement up and over, into the molding. Drive in galvanized asbestos siding nails. They come with predrilled nail holes.

If you had to cut the nails in the shingle above, drill new holes. The stubs of the old ones are still in the wall. A dab of putty or caulking seals the old holes. Don't overdrive when nailing asbestos shingles—you'll split the shingle.

Siding shingles made of wood are nailed near the bottom and penetrate the bottom portion of the overhead shingle. Depending on the length of the shingle (18 or 24 in.) and exposure to weather, the original shingle might be held by the nails of two subsequent courses.

Slip a hacksaw blade behind the damaged shingle. Cut through the nails. A Stanley blade holder is handy for this. If you don't have one, wrap a rag around the blade for comfort. Now do the same thing to the shingle above.

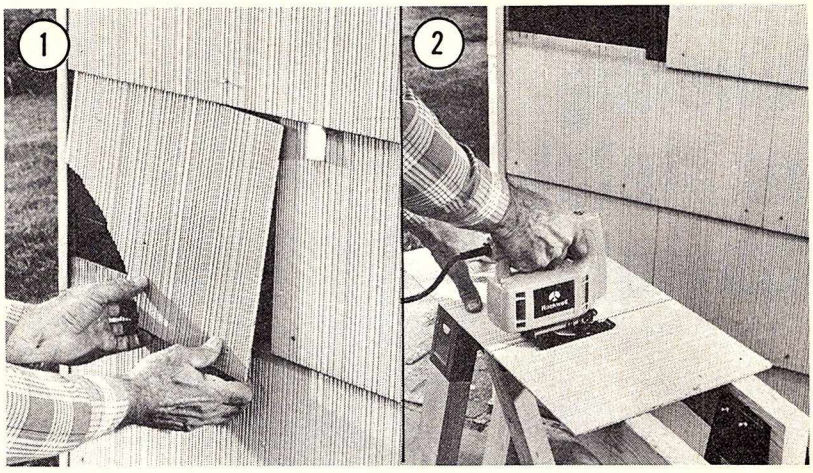
Pry the damaged shingle out a little; grip it and pull downward. If it doesn't come loose, another set of nails may be holding it. Slip the blade under the third shingle above and cut those nails.

Remove the shingle and measure the width of the void. If it's not a corner shingle, cut the new one to size. For corners, hold the new shingle in place and mark the exact shape on the side of the corner. Notice that the outside edge is slightly angled.

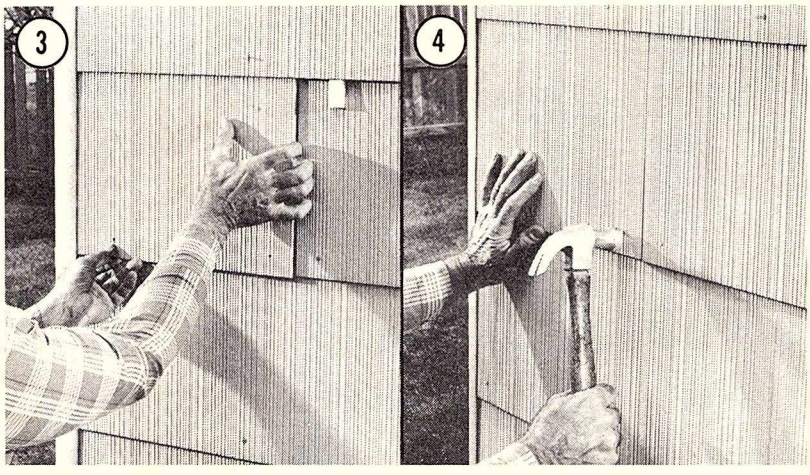
Working with house corners depends on whether you have vertical corner boards or shingle corners. If your home has corner boards, simply cut the new shingle to fit the void. Shingle corners are a bit more tricky.

Corner shingles are installed either woven or mitered. Adjoining courses extend when shingles are woven. Mitered shingles have 45° mitered edges, but rare is the corner joint that's a precise fit. If your shingles are corner-mitered, so be it; you may have to work your way through a couple of shingles before you get a perfect, flush corner-miter joint.

When the new shingle is in place, use galvanized shingle nails to hold it. Sawed-off nail stubs are still in the wall behind the upper shingles, so new nail locations must be used. Seal off the old holes with putty or pegs cut from the old shingle. Protect your home's structure *and* its neighborhood reputation! ●

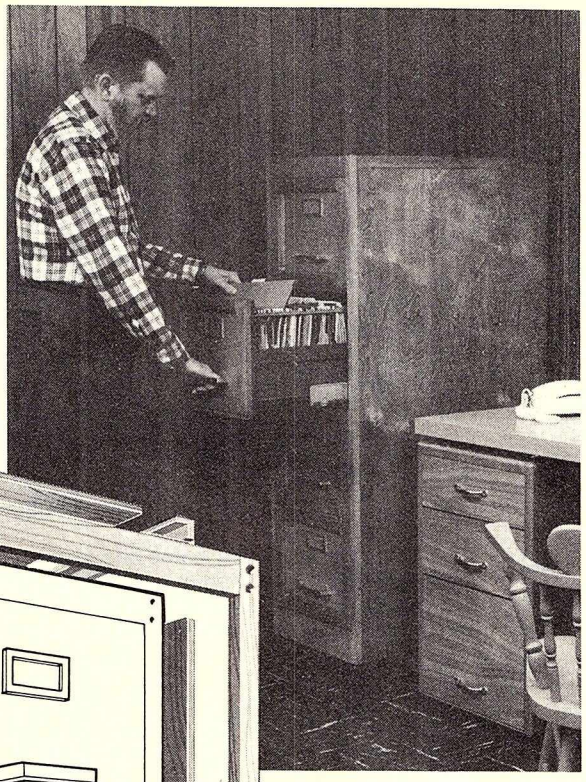


REPLACING damaged asbestos shingles is similar to wood. Loosen nails on upper shingle (1) and prop out. Pull sideways, down and out to remove. Cut new shingle with saber saw (2), push up (3) until it meets old nails, then sideways into corner. Drive nails (4) so heads touch shingle.



Pleasing Paneling For Metal Cabinets

By Thomas H. Jones

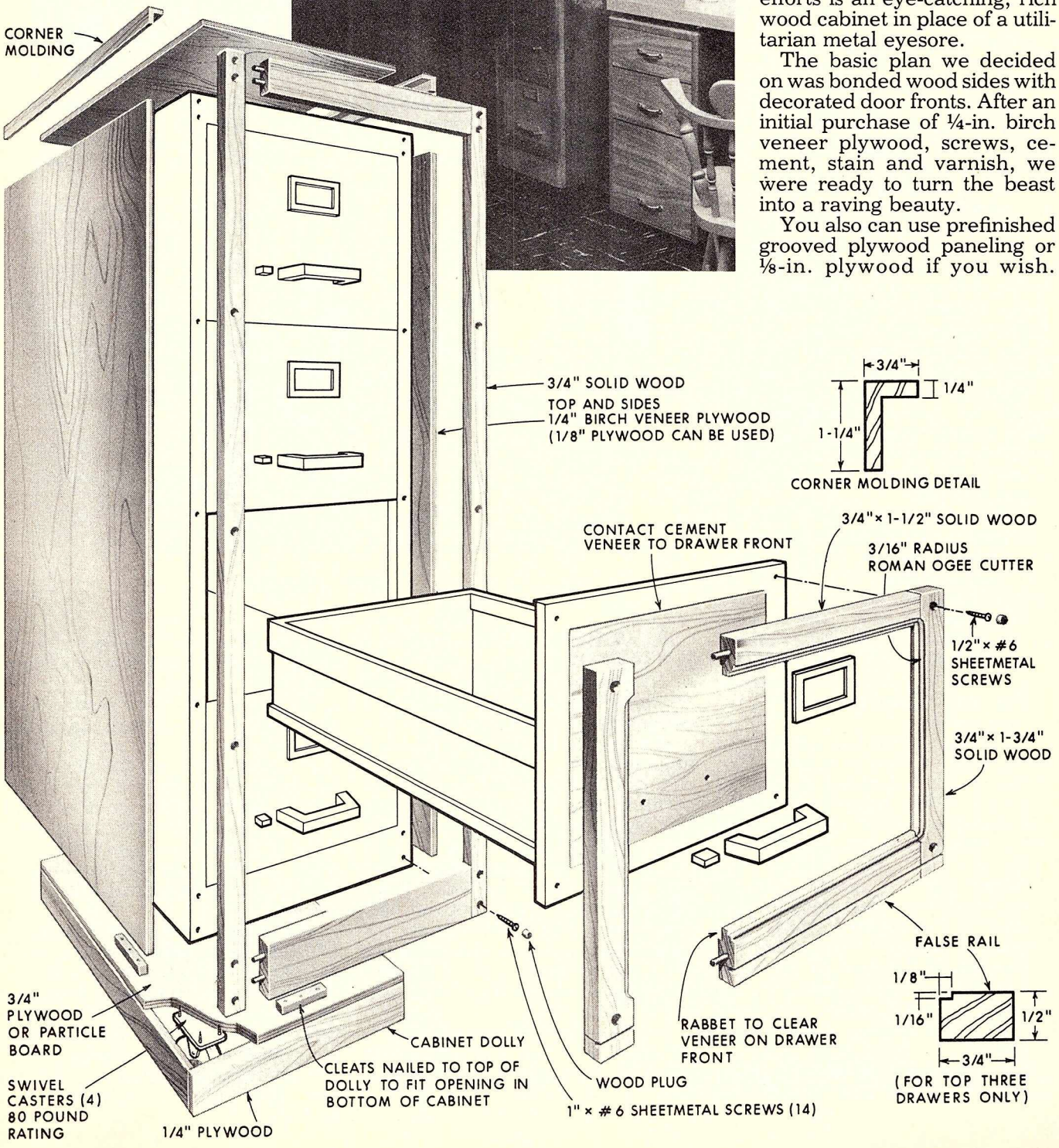


METAL cabinets of the type usually found in offices are increasingly popular items for the home office and den. Especially file cabinets. Their metal skin, however, leaves a lot to be desired because of its grim colors and cold appearance.

One of the best and easiest things you can do to warm a file cabinet's appearance and make it attractive is to panel the thing in wood—with conventional, prefinished wall paneling. What you get for your efforts is an eye-catching, rich wood cabinet in place of a utilitarian metal eyesore.

The basic plan we decided on was bonded wood sides with decorated door fronts. After an initial purchase of ¼-in. birch veneer plywood, screws, cement, stain and varnish, we were ready to turn the beast into a raving beauty.

You also can use prefinished grooved plywood paneling or ⅛-in. plywood if you wish.


CORNER MOLDING
3/4" SOLID WOOD TOP AND SIDES
1/4" BIRCH VENEER PLYWOOD (1/8" PLYWOOD CAN BE USED)
3/4"
1/4"
1-1/4"
CORNER MOLDING DETAIL
CONTACT CEMENT VENEER TO DRAWER FRONT
3/4" × 1-1/2" SOLID WOOD
3/16" RADIUS ROMAN OGEE CUTTER
1/2" × #6 SHEETMETAL SCREWS
3/4" × 1-3/4" SOLID WOOD
FALSE RAIL
1/8"
1/16"
1/2"
3/4"
(FOR TOP THREE DRAWERS ONLY)
RABBET TO CLEAR VENEER ON DRAWER FRONT
3/4" PLYWOOD OR PARTICLE BOARD
SWIVEL CASTERS (4) 80 POUND RATING
1/4" PLYWOOD
CABINET DOLLY
CLEATS NAILED TO TOP OF DOLLY TO FIT OPENING IN BOTTOM OF CABINET
WOOD PLUG
1" × #6 SHEETMETAL SCREWS (14)

Don't use thin veneer; it tends to split when glued with contact cement.

We covered the center of each drawer with veneer, then framed that with ¾-in. solid wood. Because of this framing, the front of the cabinet had to be extended with ¾-in. solid wood. That's where we started.

We fastened the stiles to the cabinet front with No. 6 sheet-metal screws and counterbored the holes to hide the screwheads. Then we doweled the top and bottom rails to the stiles. The rails between the drawers are faked to the drawer bottoms.

We thought of mitering the joint between the plywood panels on the top and sides, but decided it would never stay tightly closed. Instead, we used pieces of outside corner molding.

Side panels were a little tricky to fit. You have to lay the file cabinet on its side to fit and glue them.

We cut the sides oversize. When the side panel was pressed against the front stile, we found it wasn't exactly straight. So, we had to adjust some of the frame screws to get the plywood/stile joint tight.

With the plywood clamped against the top outside corner of the front stile, mark the back and bottom edge of the plywood for cutting.

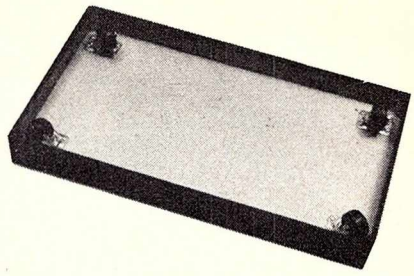
Attach the plywood panels and the outside corner trim to the file frame with contact cement. Before applying, clamp scrap blocks to the back (top and bottom) and to the bottom so the plywood can't be put down out of position. Apply glue to the top corner molding. Then get the side panel in position and glue it on.

Turn the cabinet over and repeat for the other side. Fit and glue the top panel on the cabinet, too.

Now remove the front frame, sand its inner edge, apply white glue to the edges of the side and top panels. Reattach the frame, clamping it to the sides. If the stiles twist when you tighten the screws,

(Continued on page 132)

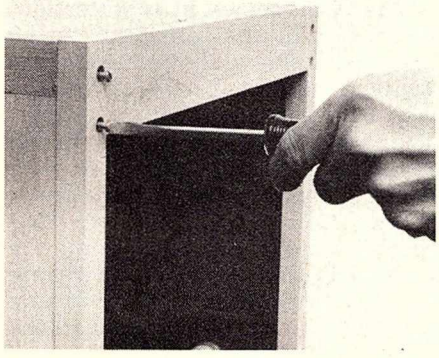
WHEELS FOR YOUR CABINET



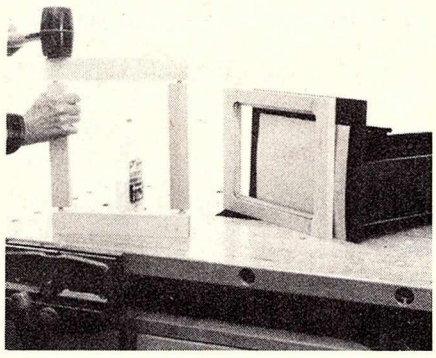
NOW that wood-paneling has turned your ugly-duckling file cabinet into a graceful piece, how do you shift it for cleaning? The solution is a dolly.

Use ¾-in. plywood as a base—or, if you wish, ½-in. particle board. The skirt is ¼-in. plywood nailed around the edge of the base. Try nailing with rosin-coated box nails to reduce splitting.

It's a good idea to reinforce the corners with molding. When done, you can paint the plywood or cover it with some scrap leatherette, as we did. Make sure the casters are swivel types, rated at least 80 lbs. each.

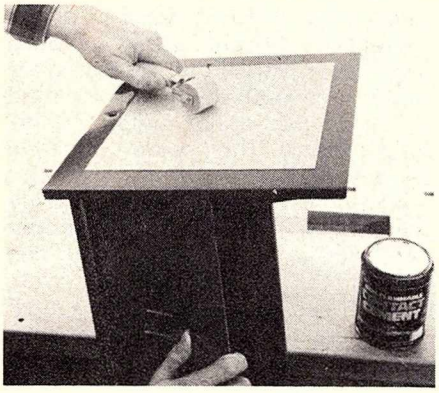


WOOD frame is attached to the front of file cabinet body with No. 6 self-tapping screws. Holes are countersunk for plugs.

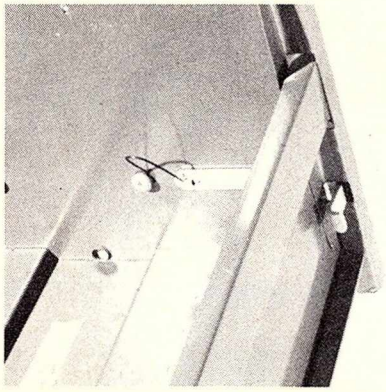


DRAWER-FRONT frames are assembled with glue, dowels. Then they are clamped flat on level surface and allowed to dry.

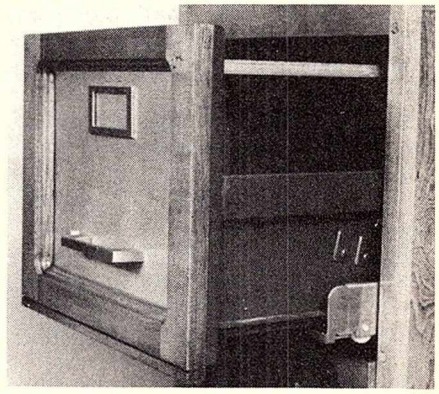
FRAMES for drawer fronts are routed both sides while clamped. Ogee bit is used on face, rabbet on back to accept veneer.



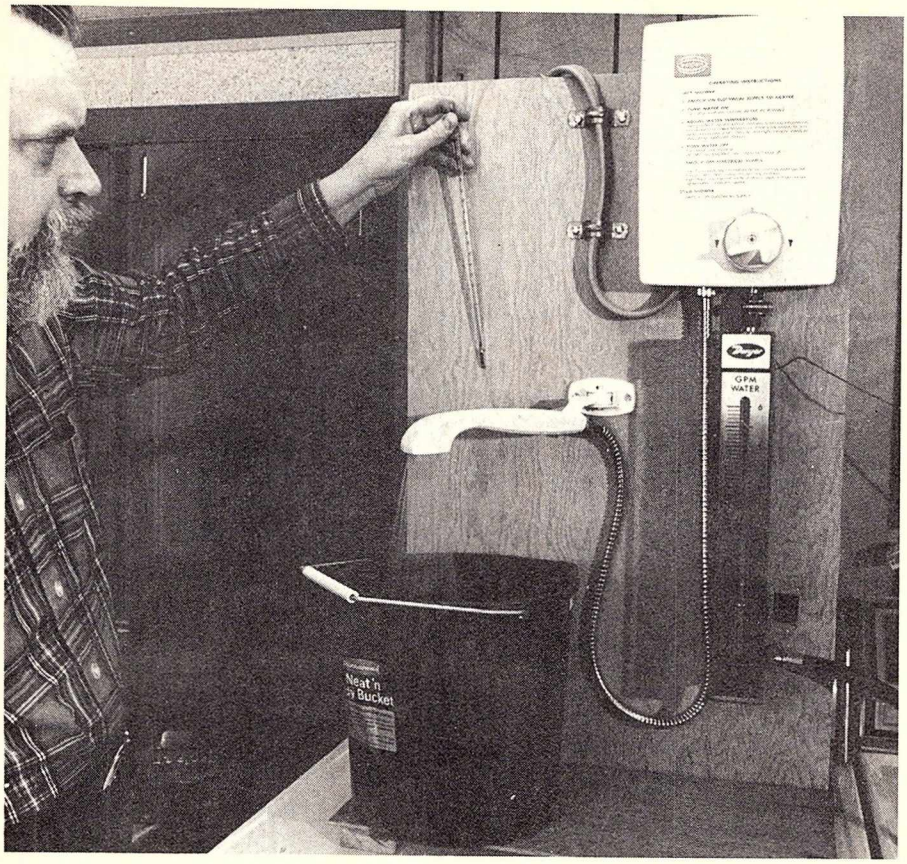
CENTERS of file cabinet's drawer faces are veneered, then holes are drilled for handle screws, latches, cardholder tabs.



WIRE spring of latch mechanism fits in hole in knob post, secures latch arm. Notch is filed in arm to compensate for veneer.



FINISHED drawer front consists of veneered drawer face, frame with ogee edge molding on inside, handle, cardholder.



INSTANT water heater was set up in homemade lab. We checked temperatures & water flow.

A Tankless Water Heater

THE IDEA of a tankless water heater for the home is downright tantalizing: Why no tank? Where does the hot water come from? Does it mean we can save on heating bills?

Good questions. And some interesting answers. The answers come in the shape of a small box that adds heat to cold water at the point of use. But let's go back to tanks for a moment.

We know that keeping a tank of hot water in the basement or in a closet and piping it through the house is anything but money-saving. No matter how well the tank is insulated, a lot of energy is wasted keeping that water hot 24 hrs. a day—just so we can have hot water for the relatively brief times we need it.

There are the tank lines, too. Whenever we turn on a hot-water tap, we let it run until the cooled water near the tap is drawn off. That's previously heated water we never used.

Then, when we're finished using the sink or shower, the hot water standing in the pipe cools down again. Heating and reheating shouldn't be the name of the game, even though it's the system we've been living with (and paying for) since central plumbing was invented.

So what's tankless all about? In Great Britain, where they only recently discovered the shower as an alternative to water-wasting deep-tub baths, more economical tankless instant water heaters are gaining wide use.

What makes them so economical is that BTUs are added to cold water right at the point of use. And they use less electrical power than a conventional water heater because you turn them on only when you want hot water.

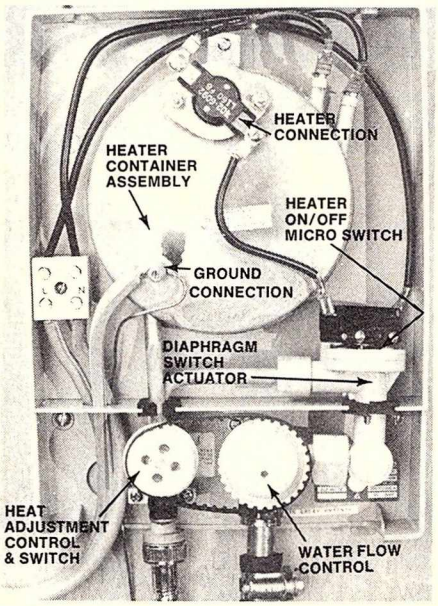
Typical of one of these tankless water heaters is the ELF, made by IMI Santon, Ltd. We tried it in a kind of homemade laboratory set-up, recording the results with a flowmeter and thermometers. But, first, the heater box itself.

The ELF comes in a watertight 4x8x11-in. plastic case that can be installed inside a shower enclosure (with a shower head) or on the wall over the sink (with a spigot). There are two controls. A knob regulates the flow of water (the heater comes on automatically when you turn on the water). The second control—a ring behind the knob—adjusts water temperature by operating a control valve for the amount of water bypassing the heater container.

Two connections are needed: cold water and electric power. You can make the water connection two ways. First, you can sweat-solder ⅜-in.-O.D. copper tubing inside a short adapter that comes with the heater. Or you can use a standard sink riser (without the adapter tube), but you have to use the kind of riser with a flat nylon flange, rather than the more common acorn type.

For power, you need a separate 230-volt, 30-amp circuit to supply the 6,000-watt heater. Power can be brought in through the wall, into the back of the ELF. You must also run a separate water-pipe ground. For our trials, we unplugged the clothes dryer and used that circuit.

We hooked up a flowmeter and measured both cold water going



COVER removed, ELF's guts include circular container for the heater, water control for flow, heat adjustment and switch.

into the ELF and hot water coming out. The results were interesting.

The ELF is rated to deliver 105°F shower water at between 1 and 1.5 gals. per min. The average flow rate for a shower is 3 gpm. Water at this temperature makes for a comfortable hot shower. This water flow would be classed as water-saving, or stingy.

Exactly how much hot water you get depends on your particular water-supply temperature and pressure. In our trials, we got our 105°F water at a flow of 1.3 gpm with a water-supply temperature of 58°F., quite high. Most city well water comes in much lower. We don't know what the pressure was, but the ELF needs at least 15 lbs. per sq. ft. to operate (it can handle pressure up to 150 psf).

When we turned the water on with more force, the temperature dropped to 95°F at 1.5 gpm. When we cut the water to 1 gpm, the water went cold—the heat cut out at the resulting low pressure.

The ELF in both concept and application is a great little heater that can be used several ways. If you have power and city water at a cabin or in a hooked-up camper, you can have an inexpensive hot shower.

You can also add an energy-saving shower to your home without the expense of running both hot and cold water. But you would have to run the separate electrical circuit.

The ELF comes with a spigot that can be substituted for the shower attachment if you want to set up for sink water.

ELF Instant Shower Heaters cost about $120 and are available from the Kiley Co., 25 Valley Dr., Greenwich, Conn. 06830. ●

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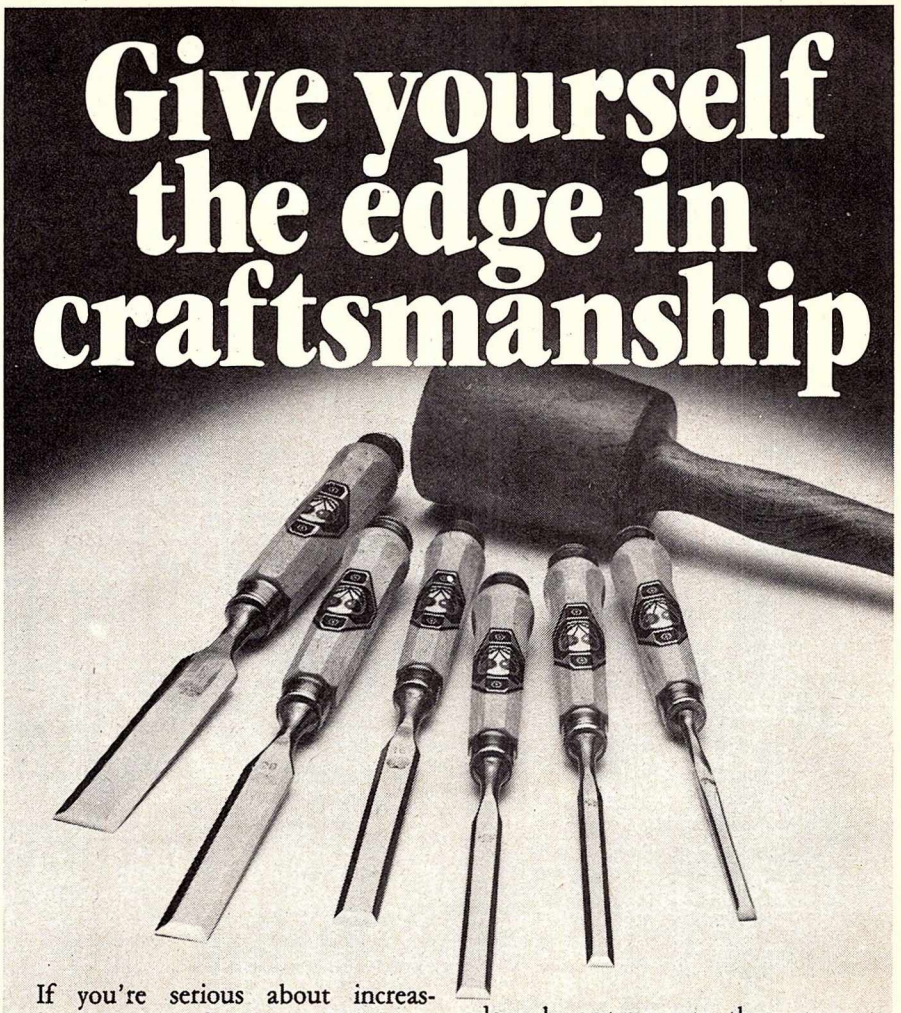

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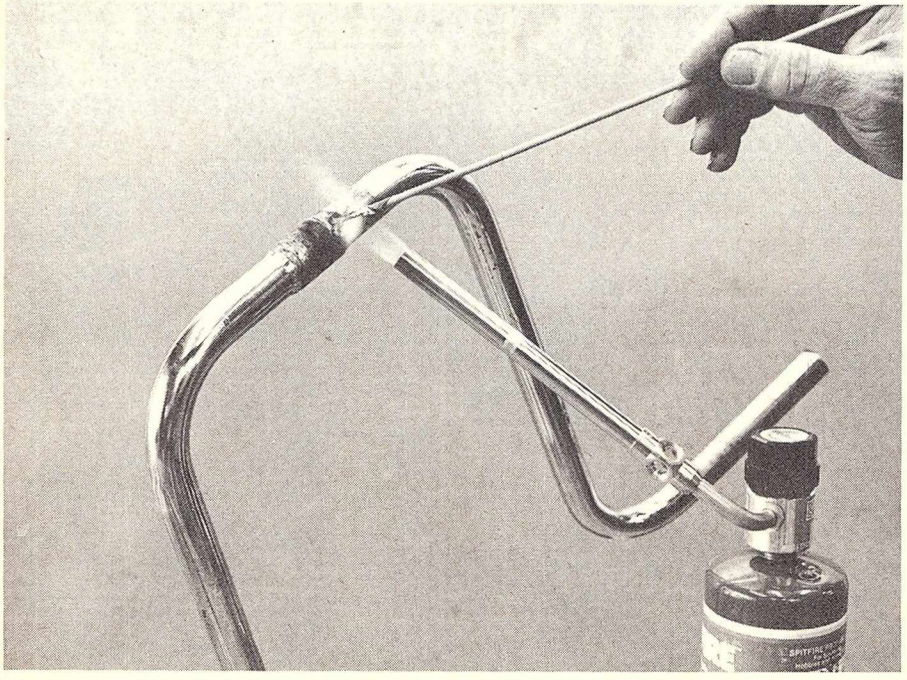
Brazing with A Propane Torch

By Rosario Capotosto



PROPANE torch with new spout design produces flame hot enough for brazing some work. No oxygen tank is necessary.

A DESIGN difference in the headpiece that screws onto a tank of propane gas makes possible brazing with propane only. Before this difference, you'd have to use a double-tank setup with oxygen.

Brazing is done at temperatures around 1,400° to 1,600°F. Getting a flame of 1,400° out of a propane torch is possible with just about any head—but getting that 1,400° to the workpiece (and keeping it at temperature) is what's new.

A head that does just that is the Spitfire. The maker, Wingaersheek, calls the action produced by the Spitfire *swirl combustion.*

The Spitfire torch has an automatic pressure regulator which meters the gas through a small, precise orifice. As the gas rushes past the jet-pump venturi the correct amount of air is sucked in.

This mix of gas and air then passes through a helical rotor inside the tube. Combustion begins at this point and the hot gases expand, generating a high-velocity swirl (not visible at the spout).

Swirling gas spins the heavier, inert gases to the outside edge or spout. These gases then act as an insulator, keeping the heat in the flame and on the workpiece.

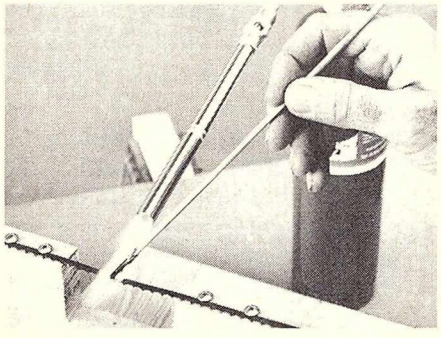
Our initial attempts at putting the Spitfire to use were disappointing. We found by trial and error that the torch has brazing limitations. It does not handle ¼-inch steel plate or ⅛-inch angle iron of sizable length. The fact is that the Spitfire is not designed for heavy or large chores. The mass of these materials simply conducts heat away from the target area, preventing it from getting hot enough to melt the brazing rod.

We found the torch quite capable of handling a variety of smaller, lighter jobs. For instance, a repair of a fractured bike handlebar, joining copper and brass to steel, reattaching a handle on a steel case and repairing a barbeque leg socket. Much to our pleasure, we brazed a broken band-saw blade—quickly and with ease.

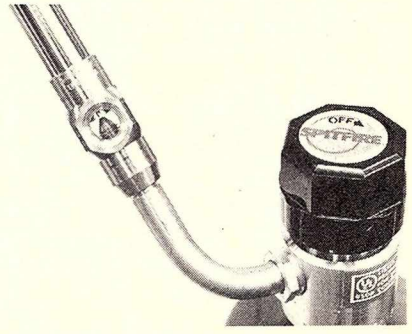
A very desirable feature of the Spitfire is that you need never be concerned about adjusting the flame—all you do is fully open the valve and ignite the gas. The flame adjusts automatically to the correct size, color and temperature.

Another good feature: The 360° swivel tip allows aiming the flame at any angle with the tank in an upright position. You don't have to use your hand to hold the tank at a particular angle.

Given the capacity for some brazing jobs, the 360° swivel-tip feature and the fact it can still be used for soldering, paint removal and pipe thawing, we think the Spitfire is the most efficient propane torch we've ever used.●



BROKEN band-saw blade was easily reconnected by heating ends to temperature, touching blade end with brazing rod.



VENTURI sucks in air which mixes with gas. Helical rotor in spout swirls mixture, resulting in 1400°F flame for brazing.

KIT for Spitfire includes large & small spouts, brazing rods, sparker, shield and flame spreader, among other torch needs.

Audi 4000

(Continued from page 53)

the 4000 is more aerodynamic than the Fox, and was designed with the help of Giugiaro, the Italian design wizard.

On the road the 4000 feels solid and safe. It is quiet and luxurious, with interior color-keyed to the exterior. The bucket seats, with adjustable backrests, give reassuring support when cornering hard, and the adjustable headrests can be removed. Rack & pinion steering with negative steering offset places the car exactly where you point it while helping to keep it on course in the event of a tire blowout. Brakes are discs in front and self-adjusting drums at the rear.

The engine is the well-known 97-cubic-inch (1,588cc) in-line Four with belt-driven overhead camshaft. It's canted at 20° to allow for the low hood line. It has Bosch injection and electronic ignition.

Unfortunately, with its exhaust laundered to U.S. standards, the engine puts out only 78 hp. That's much less than the European version. Weight is up, too—2,260 pounds vs 2,050. And since European test cars seem to have difficulty in achieving the claimed 0- to 50-mph time of 8.1 seconds, it was no surprise that the American version I tried couldn't do it either.

When cornering fast there's moderate understeer with slight, safe tightening of the line if you lift off in midcorner. The steering wheel doesn't kick back on bad roads, and at 3.9 turns lock-to-lock for a 32½-foot turning circle, it's light enough for the average woman to be able to park without having to turn into the Incredible Hulk. To add to the car's civility there's a deep trunk, too, with useful space increased by a spacesaver spare.

Lack of wind noise when traveling fast is one indication of a good body shape. This is confirmed by wind-tunnel tests indicating a drag coefficient 7 percent better for the new shape than the old. That helps fuel economy. Official EPA figures indicate 22 mpg overall. With a 15.8-gallon tank, light-footed drivers could have a cruising range of up to 500 miles.

Lastly, when you get in the car you notice things. Like how the Audi 4000 is put together; how things fit, match, line up. Quality design is nothing new for Porsche/Audi. They first rolled a car downhill for a crash test 42 years ago. When they put it back on its wheels after three somersaults, all the doors could still open and shut. So they filled it up with gas and drove it away. And they still have film to prove it. ●

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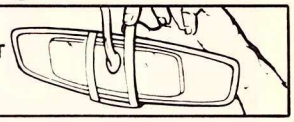

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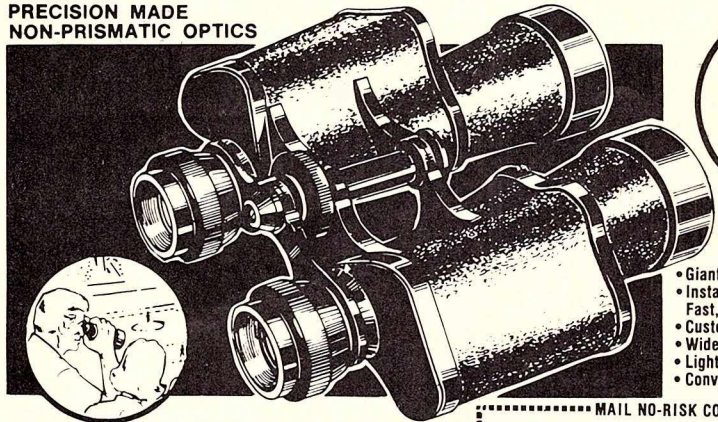

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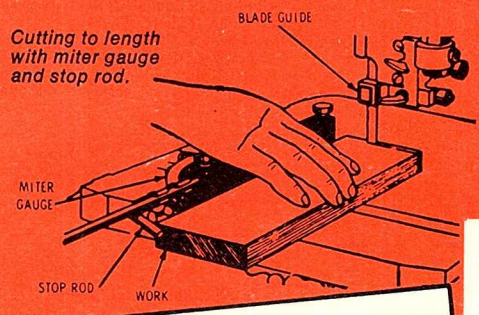

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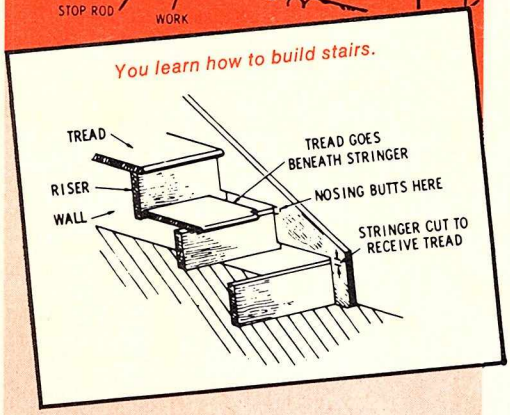

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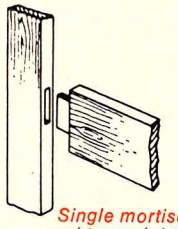

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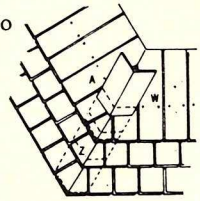

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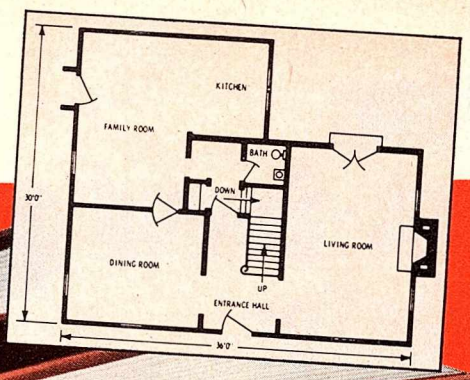

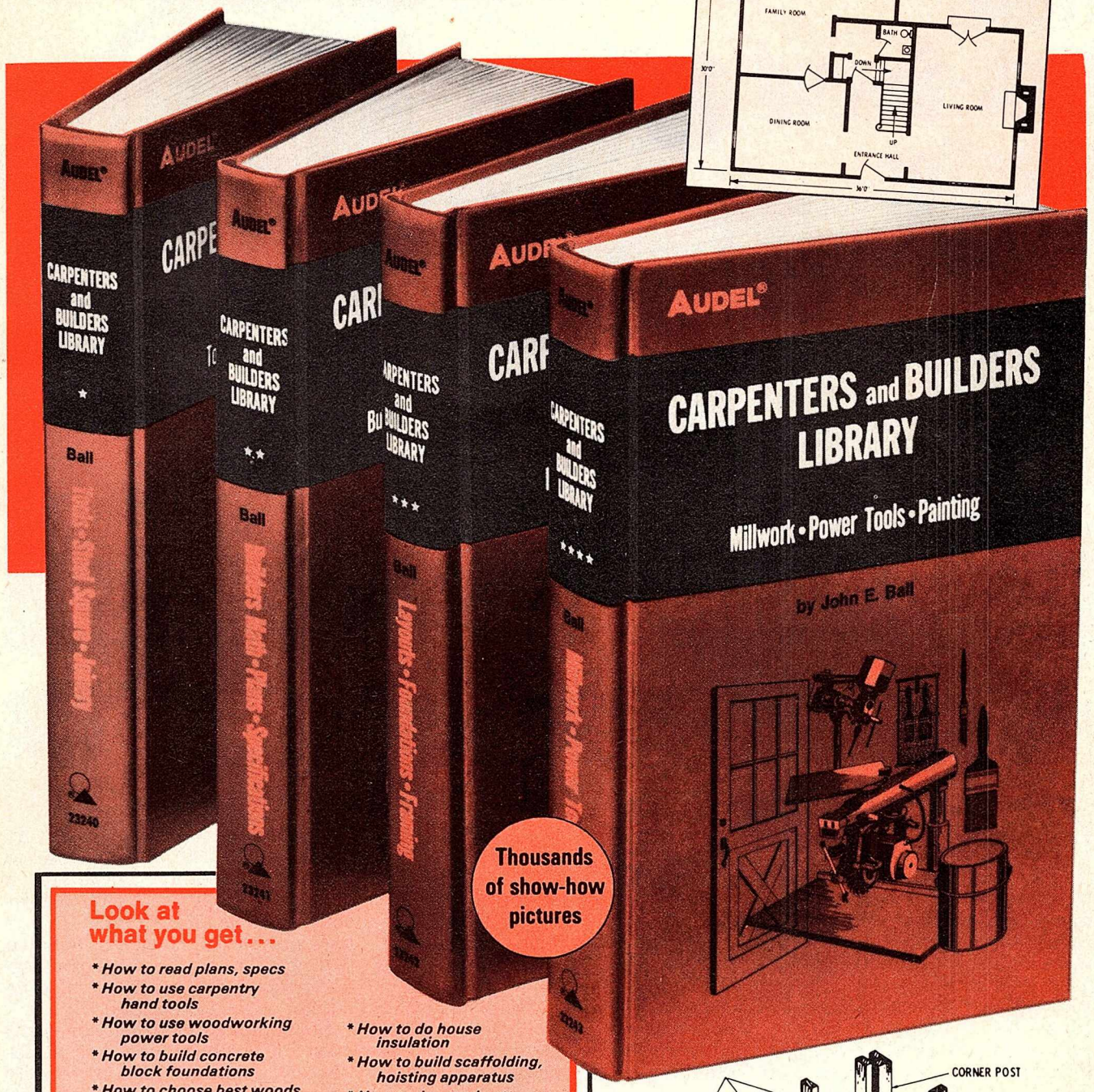

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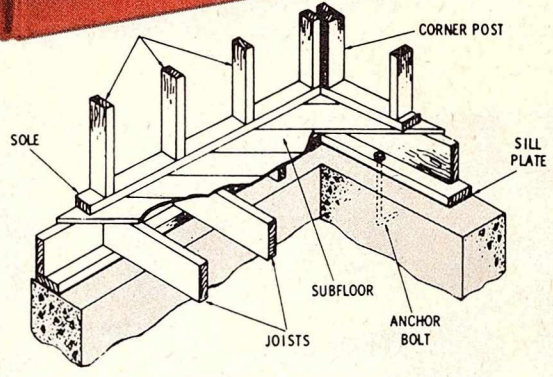

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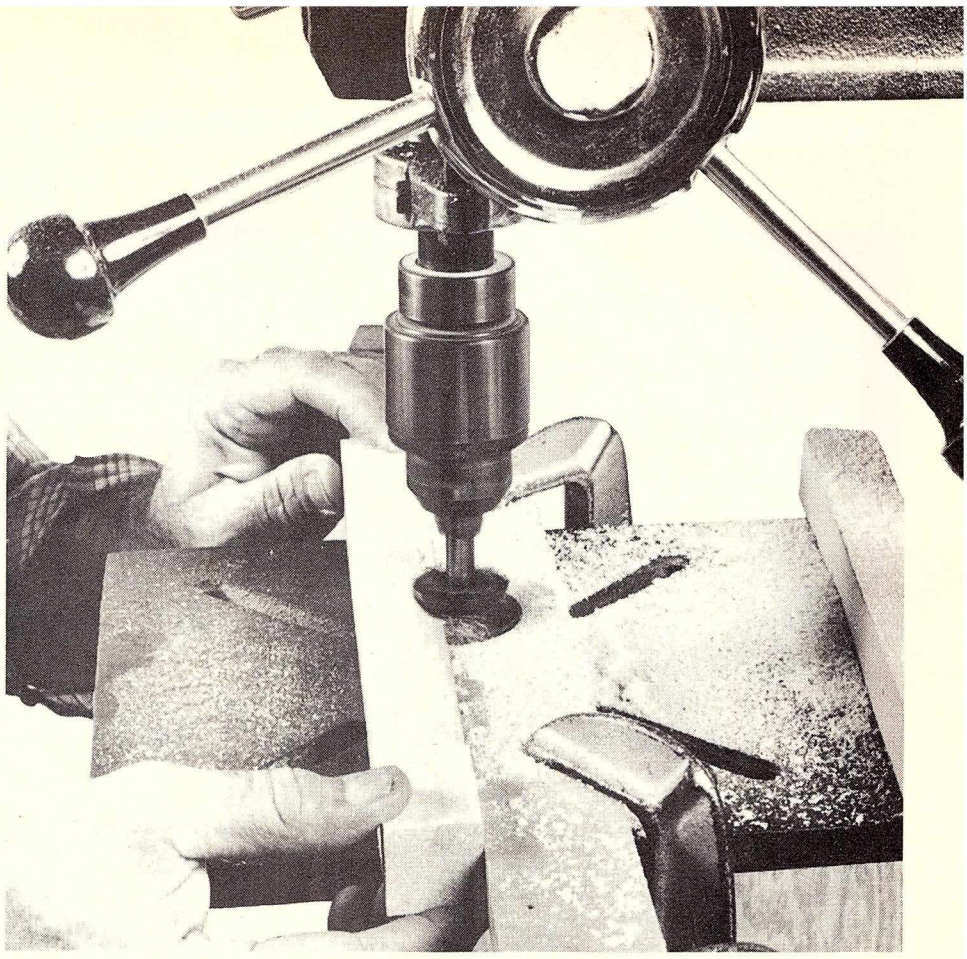
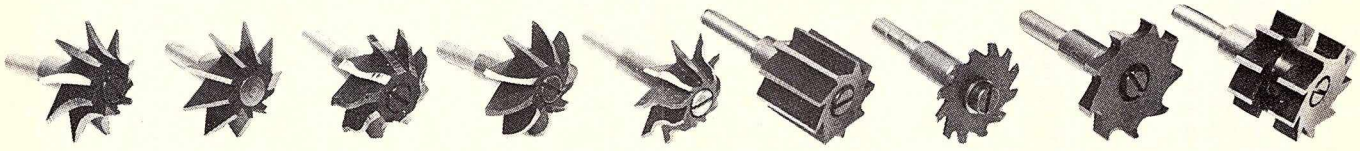
Now: Low-Speed Bits for Shaping

By Rosario Capotosto



LOW-SPEED bits mean you can shape decorative edges on workpieces with low-rpm power tools like a drill press (right) or with jigged, portable power drill.Low-speed shaper bits have 9 cutters (with the exception of the slot bit), whereas high-speed bits have 2 cutters. Made by Portalign, they come in (l. to r. below) round, chamfer, bead, cove, hollow bead, mill, slot, groove and tongue shapes. Low-speed shaper bits also have larger overall diameters.



THE ABILITY to shape decorative edges on workpieces or to cut decorative molding strips for attachment to plain edges has largely been the job of high-speed shaping tools. Now you can make fancy edges with relatively low-speed tools like a portable power drill with—what else?—*low-speed* shaper bits.

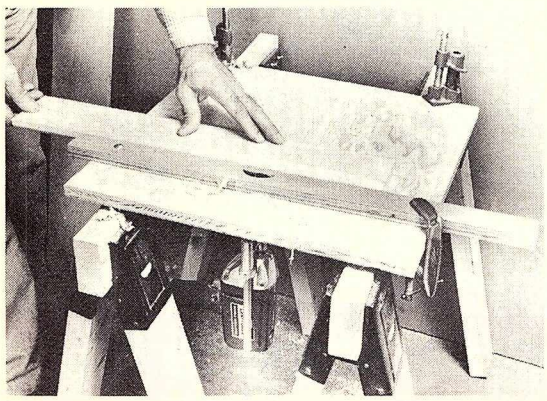
It's a dandy innovation. You don't have to buy an extra tool (unless you're into shaping in a heavy way), just the bits designed for cutting at low speeds. The bits come from Portalign, the people who developed a drill guide some years ago. They have married their bits to their drill guide, naturally enough, but you also can use them with a drill in a homemade jig or in a drill press.

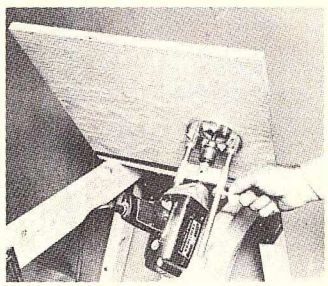
A high-speed router bit typically has two cutting edges (or cutters) only and depends on the extremely high rpm (28,000) of the router to cut stock smoothly. Therefore, it doesn't work if used with a low-rpm portable drill. These unique low-speed bits, however, achieve cutting efficiency because of a larger bit diameter and a set of *nine* cutting edges (or cutters).

For shaping, the drill (¼ or ⅜ in.) must be firmly mounted in a stationary position. This is readily accomplished with the use of Portalign's Precision Drill Guide (an earlier introduction) mounted to the bottom of a worktable or to a plywood board mounted on a pair of sawhorses.

In lieu of the Portalign Guide, a portable drill stand or a full-fledged drill press can be used. We tried shaping with all three methods and the results were quite satisfactory.

The Portalign bit series consists of various shapes, including tongue, groove, cove, mill, slot chamfer, round, bead and hollow bead. They're meant to be used with chuck speeds up to, but defi-





SETUP with both Portalign bits, guide involves securing guide (with drill attached) to underside of board (above) with fence.

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FILTER 100's: 10 mg. "tar", 0.8 mg. nicotine, FILTER, MENTHOL: 11 mg. "tar", 0.8 mg. nicotine, av. per cigarette, FTC Report MAY '78.

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nitely not exceeding, 4,000 rpm.

Using a board-mounted ⅜-in. variable-speed drill at a top speed of 1,200 rpm with the Portalign Guide, we were able to shape edges in both sugar pine and cherry with quite good results. With the soft pine a single pass did the trick, but with the harder cherry we found it necessary to make the cut in several passes—to prevent chattering and to avoid straining the drill. The bit was simply adjusted to take a wider cut by moving the fence after each pass.

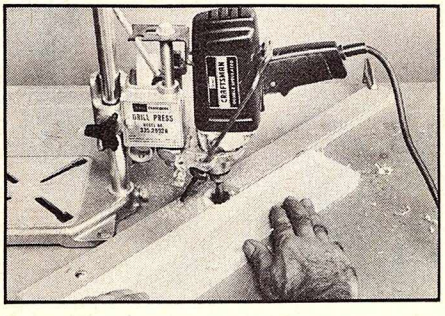
With the drill mounted in a stand, the results were similar. The only difference is that the cut can be observed in progress. For some applications, such as a stopped cut, this mode of operation is advantageous.

Switching to a regular drill press with higher rpm (2,350), the cutting operation went faster. In all cases, a board fence with a half-circle cut into it is necessary for guiding the work and to control the depth of cut.

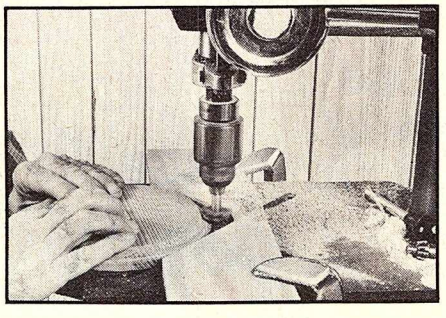
Inasmuch as the bits don't have pilots, the Portalign concept basically is for straight-line shaping. With a simple jig consisting of a board with a V-notch cut into it, circular edge-shaping also can be readily done.

A few of the many jobs these shaper bits can handle are decorative edging for plaques, fancy molding, rabbet cuts, edge-milling for butt joints, tongue-and-groove joints and precision cuts for hobbies and crafts.

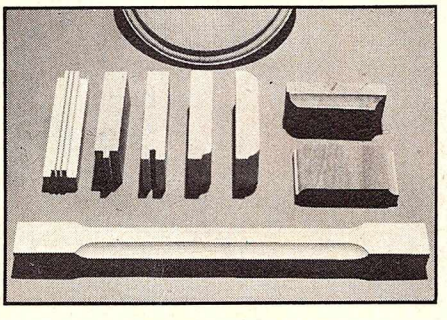
The bits are marketed by Portalign Tool Corp. (Box A-80547, San Diego, Calif. 92138) and are available at home centers and hardware outlets. Bits are individually packed, and prices range from $3.95 to $7.95 each, depending on the intricacy of the bit shape. ●



PORTABLE power drill mounted on mini drill press stand, swung to outside, allows you to shape in an overarm mode.



BITS in drill press with V-notch board fence (clamped to table) permit you to shape, decorate edges of circular workpieces.



KINDS of cuts you can make with low-speed shaper bits include most of the variations you get with high-speed bits, router.

Drums, Discs And Now, Cones

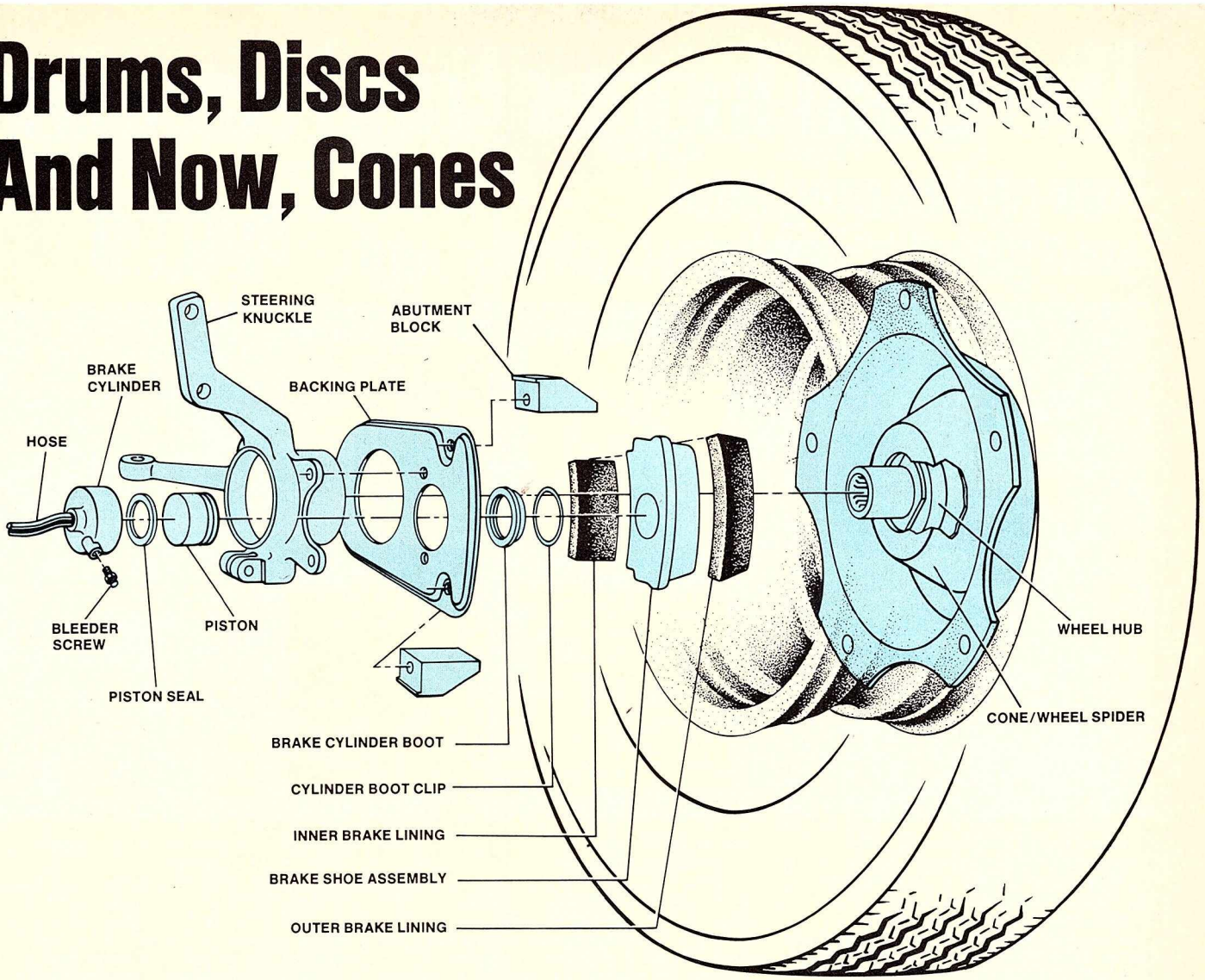


ILLUSTRATION shows relation of parts of cone brake setup used in test VW.

SINCE the beginning of wheeled transportation there have been numerous methods used for stopping those wheels.

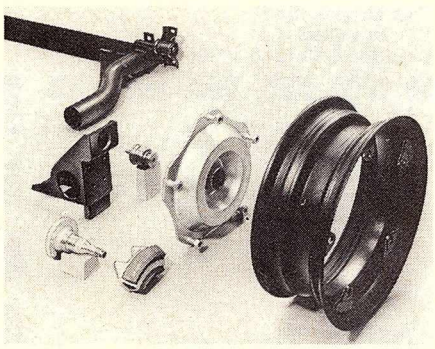
Feet dragging and big rocks on the end of a rope came first. But they proved to be ineffective as the transportation grew more sophisticated.

Then came the car. Automobile braking systems started out with a hand-type affair mechanically applied to the drive shaft or the wheel hubs. That gave way to the hydraulically applied shoe and drum. Later the disc and caliper evolved.

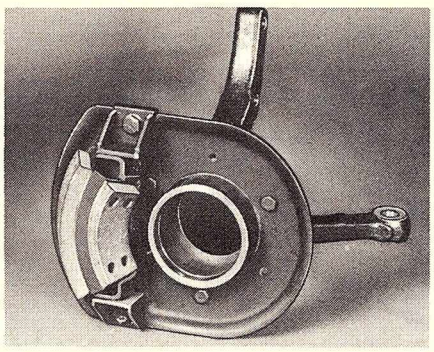
Now a new generation of brake is being developed in keeping with industry demands for light weight and increased efficiency. The latest concept is called the cone brake. Developed by U.S. Steel, this new system reduces weight by as much as 50 percent and simplifies production and maintenance by utilizing fewer parts.

The main feature of the assembly is the stamped steel cone-shape rotor which takes the place of the presently used drum or disc. It also acts as the spider, or center section,

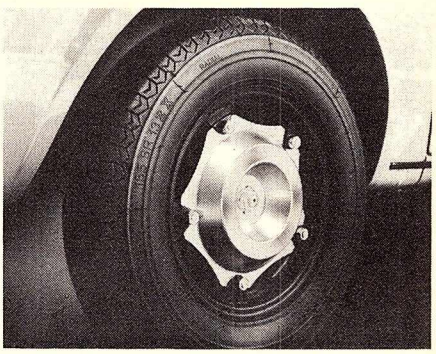
(Continued on page 135)



LIGHT WEIGHT and simplicity are brake's big virtues. With setup on all wheels of VW there's 44 percent weight savings.



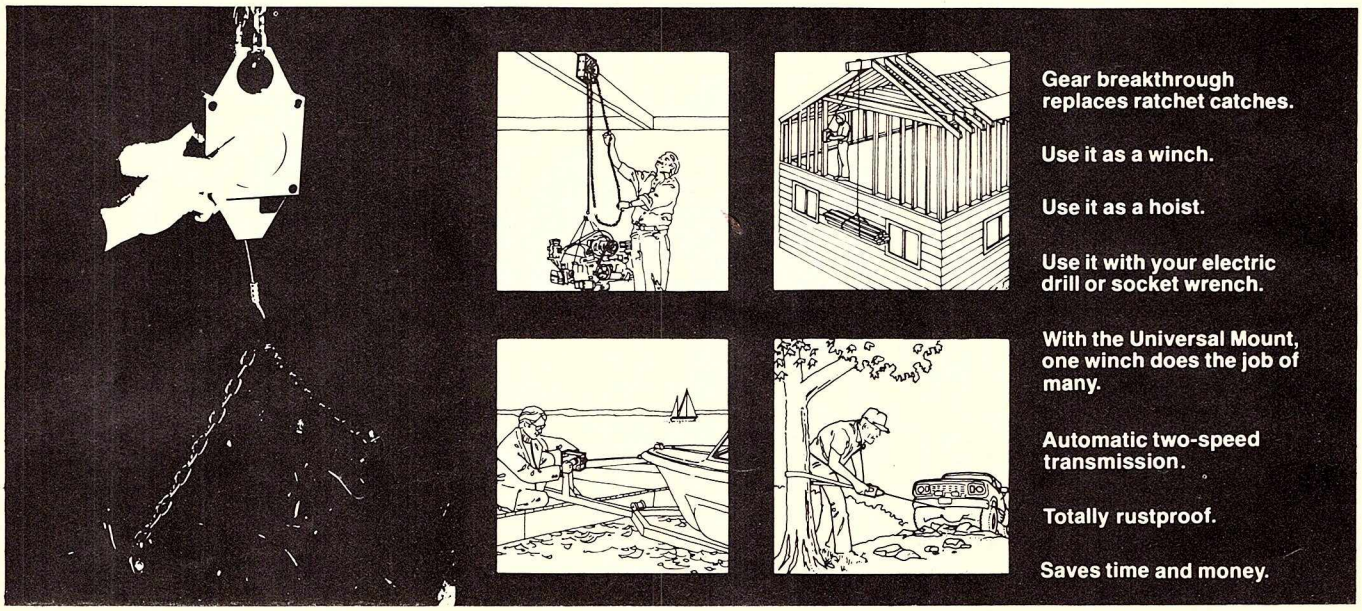
FRONT BRAKE shows three-sided brake shoe held to its backing plate by two blocks. Hydraulic piston activates shoe.



CONE BRAKE gets its name from conical shape of wheel's center section, which is the equivalent of standard drum or disc.

The Easy Tugger™ Load Handler

Your profits may soar from gear technology breakthrough. $29.50


Gear breakthrough replaces ratchet catches.
Use it as a winch.
Use it as a hoist.
Use it with your electric drill or socket wrench.
With the Universal Mount, one winch does the job of many.
Automatic two-speed transmission.
Totally rustproof.
Saves time and money.

With a small investment in an Easy Tugger™ load handler you will increase profits by saving time, money, and trouble. The safety, convenience, and low price of the Easy Tugger™ is made possible by a revolutionary new breakthrough in gears and power transmission protected by a variety of U.S. and international patents including U.S. Patent No. 3,895,540. This new technology puts the old-fashioned winch and hoist in a class with the dinosaur—clumsy, unsafe, heavy, out-of-date.

Safest

Easy Tuggers™ are much safer than ordinary winches and hoists. A case protects fingers and knuckles. A replaceable shear ring prevents accidental lifting of oversize loads that might break the cable. There is at least a 400% over-design on all parts. And our **Load Handling Handbook,** included free with each Easy Tugger™, will make you a pro at pulling and lifting.

Strongest

Tool Master's Easy Tugger™ has the highest strength-to-weight ratio of any winch. The Easy Tugger™ body is designed to take an 8,000 pound load, and its cable has a safety factor of four times its advertised rating, and it has a totally rustproof case and drive unit.

Saves You Money

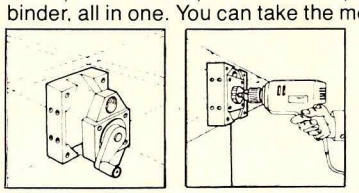
The Easy Tugger™ costs less and does more than the old-fashioned winch or hoist. Use an Easy Tugger™ to help on those jobs which would ordinarily require expensive extra labor, or a serviceman, jobs like repairing your own car or moving things around the house. Carry one next to your spare tire to pull your car out of a ditch or to use as an emergency tow cable. The Universal Mount, available separately, allows one Easy Tugger™ to be moved easily and quickly from one job to another.

The Easiest to Use

The hand cranked Easy Tugger™ can be driven by an electric drill or socket wrench and will adapt to virtually any load handling problem. The cable automatically locks in position with no ratchet catches. The Easy Tugger™ has an automatic two-speed transmission which gives maximum efficiency in handling light or heavy loads. You never waste time winding in the cable and the Easy Tugger™ is instantly ready to lift a heavy load.

Use it Everywhere

The Easy Tugger™ can be mounted vertically or horizontally, on just about anything; it can be attached with bolts, a chain, a hook, rope, stake, or trailer hitch. This load handler is a boat winch, a utility winch, a chain hoist, a ratchet hoist, a load binder, all in one. You can take the motor out of your car with the same Easy Tugger™ you use on your boat trailer.



If you use tools, you need the Easy Tugger. The Easy Tuggers™ come in five models for every application—hand powered in ½ and 1 ton models, 1 ton "endless chain" powered, and 1½ ton 110V AC electric "Home and Shop Model," and 1½ ton 12V DC electric "Outdoor Recreation Model." Information options will be sent with each order. Even if you already own a winch, you should order a copy of our **Load Handling Handbook,** for $3.50 just to find new ways to use it.

No Risk Guarantee

Too good to be true? Try an Easy Tugger™ for thirty days without obligation. If you're not satisfied, just return it and your money will be refunded.

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_____ ½ ton Hand Powered Easy Tuggers™ with 12' cable @ $29.50 _____

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Colorado residents add 3% sales tax _____

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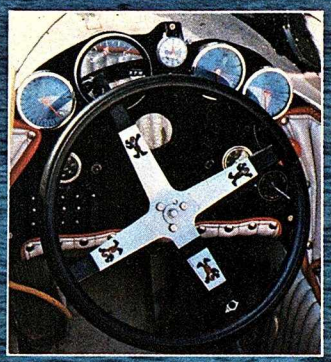
BOATING '80

THUNDER ON THE WATER

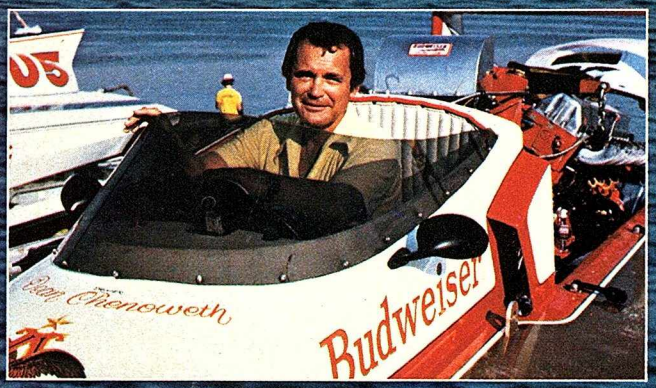
By Wayne Thoms
WEST COAST EDITOR

They call them *Thunderboats!* And they're the fastest rigs on the water.

THROATY roar of WWII-vintage aircraft engines gives thunderboating its name. Above, Bill Muncey on a run.



HYDROPLANE cockpit (right) is just forward of engine. Gauges tell driver speed, oil pressure and rpm. Slipping into seat (below) is no easy task since each one is custom-molded for driver, but author managed to squeeze in behind the wheel.



WE'RE a half-dozen miles from San Diego's Mission Bay when first we hear the muted rumble of an unlimited hydroplane. With sound like this from only one boat on a qualifying run, the name *thunderboat* seems especially appropriate. As we move closer to the bay, the noise envelops us and generates a gut-level sound much like Grand Prix competition or closed-course air racing.

If the throaty roar of huge aircraft Allisons, Rolls-Royce Merlins and an occasional R-R Griffon is not enough, the sight of a hydro clipping wavetops at 175 mph, trailing a 300-foot-long roostertail that arches 50 feet into the air, should impress the most hardened sports buff.

The spectacle and noise of six boats pounding around a 2½-mile watery oval is what attracts huge crowds to these events. Upwards of 100,000 watching from shore and aboard boats is not unusual. One memorable race in Seattle a few years ago drew an all-time record of 750,000.

If it provides a pleasant summer Sunday for race fans during the June-September season, a race weekend is anoth-

er story for owners, crews and drivers. Thunderboating is expensive and dangerous and demands long hours of hard work. And yet, prize money, typically about $45,000 per event for a nine-race season (plus a bit more for the annual Gold Cup race), is not exactly a get-rich-quick scheme.

This is no sport for the faint of purse. A new unlimited hydro, ready to race, costs about $250,000. Add to that the cost of spare engines (some teams keep ten or more at $15,000 a copy), boat transporter, semi-trailer with complete workshop, full-time crew chief and three or four mechanics and a driver and you understand why a first-class racing effort may be budgeted at $300,000 a season.

The key to thunderboating is the thunder that powers the boat. An unlimited hydro has no engine-size restriction (hence the term *unlimited*) and most boats use surplus World War II aircraft engines. The Allisons were built for the P-51 Mustang and the Merlins powered British fighters. A few racers turn up with hot-rod Fords, Chevys and Chryslers (sometimes a pair of them) but they are rarely competitive.

A three-point hydro—most boats use this design—is an unusual combination of aeronautical engineering, exotic materials and builder's instinct. It's called three-point because at racing speeds the boat rides up on the two hull sponsons and the lower half of the prop. It's the prop, spinning at 12,000 rpm, which scoops water into the roostertail.

We were able to take a close look at several of the world's best thunderboats. One of the newest, *Miss Circus-Circus* (a Nevada hotel sponsor) seems to typify the currently favored cabover design, in which the driver sits in front of the engine. The driver sat well aft on the older boats and claimed better control. However, cabover designs are faster, ride smoother and drivers have now accepted them.

Miss C-C is 13 feet 10 inches wide and 29 feet long. The center wing of the hull is 90 inches wide, wider than earlier designs, which causes the boat to ride light in the water due to aerodynamic lift. Obviously, this lift must be in delicate balance with staying on the water. Thunderboats have been known to perform aerial loops that destroy boat and sometimes driver.

Conventional boat materials include African marine plywood, clear-grain ash, Canadian spruce and fiberglass. Honeycomb aluminum panels, a result of aerospace technology, are used for the hull.

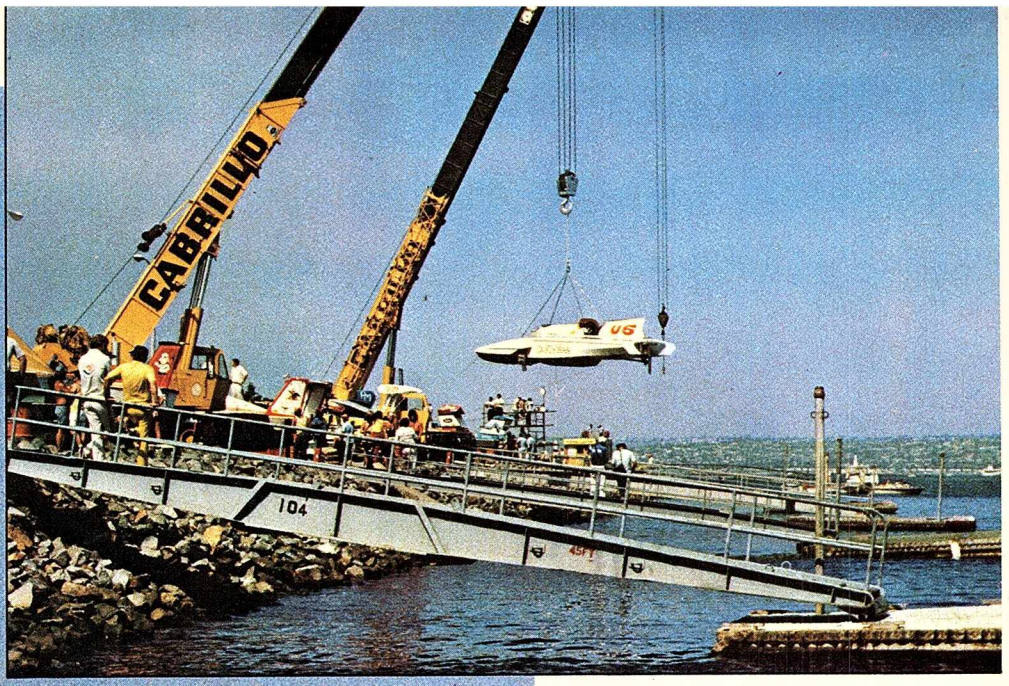
We roamed the Mission Bay pit area and counted 11 boats. That's not too many, but it's an average turnout, considering that there are only about 30 unlimited hydros registered in the U.S. One boat never competed, but the others managed to qualify by making the required

DISTINCTIVE roostertail can stretch out 300 ft. behind a boat. It's caused by a propeller that spins at 12,000 rpm.

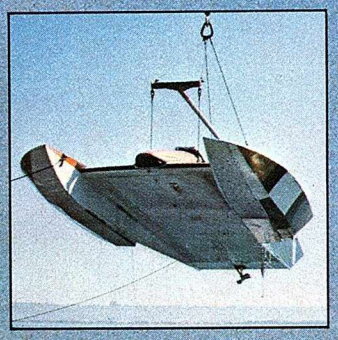
RACING ON A SHOESTRING

There is a poor-boy approach which puts thunderboating within reach of many more would-be racers, provides an excellent learning ground for unlimited driving but gives little chance of winning. It works like this: Buy an older boat (presumably outclassed), recruit volunteer crew members, find a talented driver eager to move up and go racing.

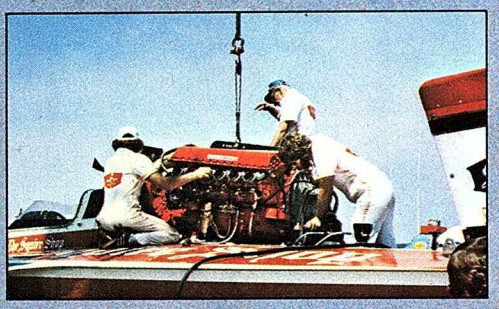
Older boats can be found for about $12,000 and up; a local sponsor helps defray operating costs. If the driver is willing to drive conservatively, then the engine should last. By driving just fast enough to qualify, and simply finishing heat races, the driver



BOATS are lifted from water after every race to keep them from sinking. Repairs, engine changes are made on land.

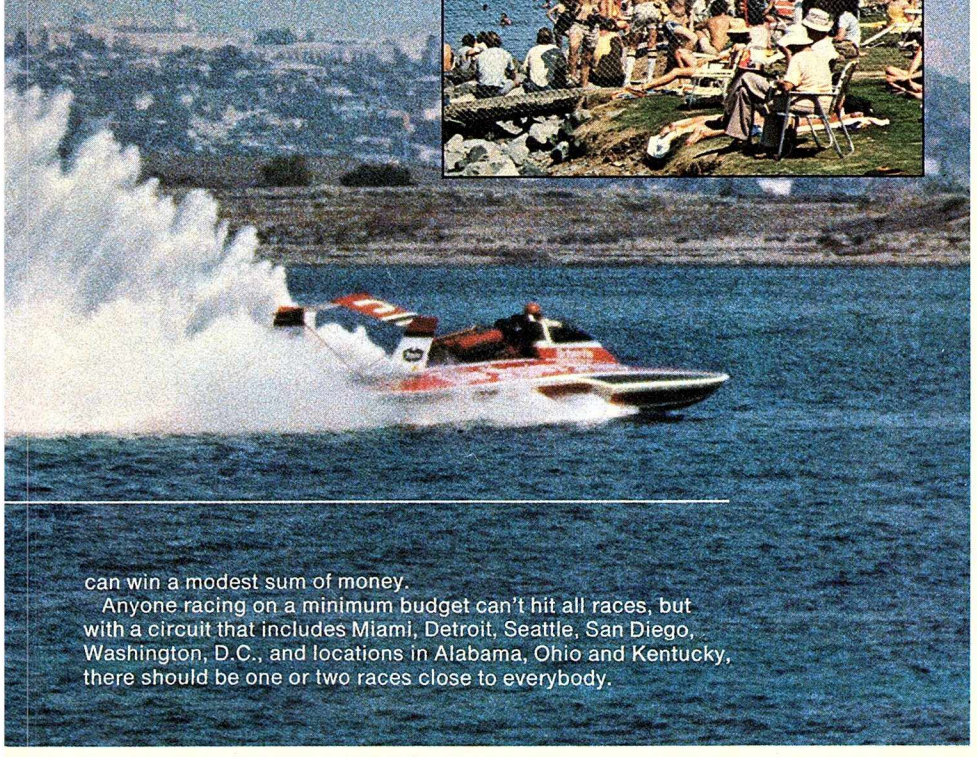


SPONSONS (above), the pontoonlike attachments on either side of the hull, force air under the boat, raise it off the water.



CREWS (right) replace engines after every race. Practice cuts down wear and tear and helps prevent blown mill during race.

SPORT draws huge crowds that picnic along water's edge during heats. One event in Seattle drew 750,000 avid spectators.



can win a modest sum of money.

Anyone racing on a minimum budget can't hit all races, but with a circuit that includes Miami, Detroit, Seattle, San Diego, Washington, D.C., and locations in Alabama, Ohio and Kentucky, there should be one or two races close to everybody.

95-mph minimum for a 2½-mile course. (A 2-mile circuit requires 91 mph, while it takes 100 mph to qualify on a 3-mile course.)

These qualifying rounds provide a considerable contrast to auto racing. Mission Bay qualifying speeds ranged from *Precision Marine*'s 95.745 mph to *Atlas Van Lines*' new record of 133.929—a far greater spread than one would find in the field of a major auto event.

Tom Martin piloted *Precision Marine;* the Atlas boat is owned and driven by Bill Muncey. At 50, Muncey has been racing for 28 seasons, has just won his seventh national championship and has more than 50 career wins. It seems unlikely anyone can match his record.

We discussed the rigors of unlimited racing with Muncey. It's a sport requiring physical stamina—understandable in a fume-filled cockpit where the temperature may reach 200°. Add to that the concentration necessary to jockey for position while zipping over waves and you have a demanding occupation.

The first thing that happens in any race, the boat is lifted from its cradle and lowered into the water. Returning from a run, boats are lifted from the water immediately upon reaching the dock and not put back in until time to fire the engine again. The reason for this constant shuffling is that the boat may sink if allowed to stand at a dock. Also, the big-bucks teams change engines the way you might change shirts on a sweaty afternoon, and it's much easier to work on land

(Continued on page 130)

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When your taste grows up, Winston out-tastes them all.

Only Winston's Sun-Rich™ Blend of the choicest, richest tobaccos tastes this full and satisfying.

Winston after Winston.

BOX: 19 mg. "tar", 1.3 mg. nicotine, KING: 20 mg. "tar", 1.3 mg. nicotine, av. per cigarette, FTC Report MAY '78.

Warning: The Surgeon General Has Determined That Cigarette Smoking Is Dangerous to Your Health.

FRANCO-AMERICAN diesel pushes 25-ft. Bayliner. It's a Renault block marinized by Mercury Marine and sold through Mercury market system. Two hp ratings: 145 and 240.

SPORTY DIESELS... NEW WAVE ON THE WATER

By Norman Phillips

More and more, fast-action speed-demon type sport boats are being mated with high-performance diesel power plants.

TIME was when the term *diesel marine engine* was synonymous with big, heavy and slow. The engines were used mostly in work boats, and were as noisy at cruising speeds (which were slow) as your aunt Minnie's false teeth on a chilly night.

Now that's true no longer. A new generation of diesel engines is appearing on the marine market, capable of pushing a good-size boat at planing speeds. These engines differ from the old workhorses by being smaller and lighter and featuring a short stroke with high rpm.

What's happening is the high-rpm diesel engines recently developed for cars are being adapted for boats. Now boats, too, can have a diesel engine that goes *vroom! vroom!*

First came the Chrysler Nissan diesel in late 1977. Then came Volvo Penta's in early '78, followed by their turbocharged AQD40 model in early '79. Mitsubishi introduced a diesel in this country in mid-'79. And the BMW diesel burst upon a waiting world at the same time.

The latest diesel character to enter onto this stage is Mercury Marine's new 145 DTS MerCruiser, introduced last August. It is accompanied by its larger brother, a 240-hp MerCruiser scheduled to be available this month.

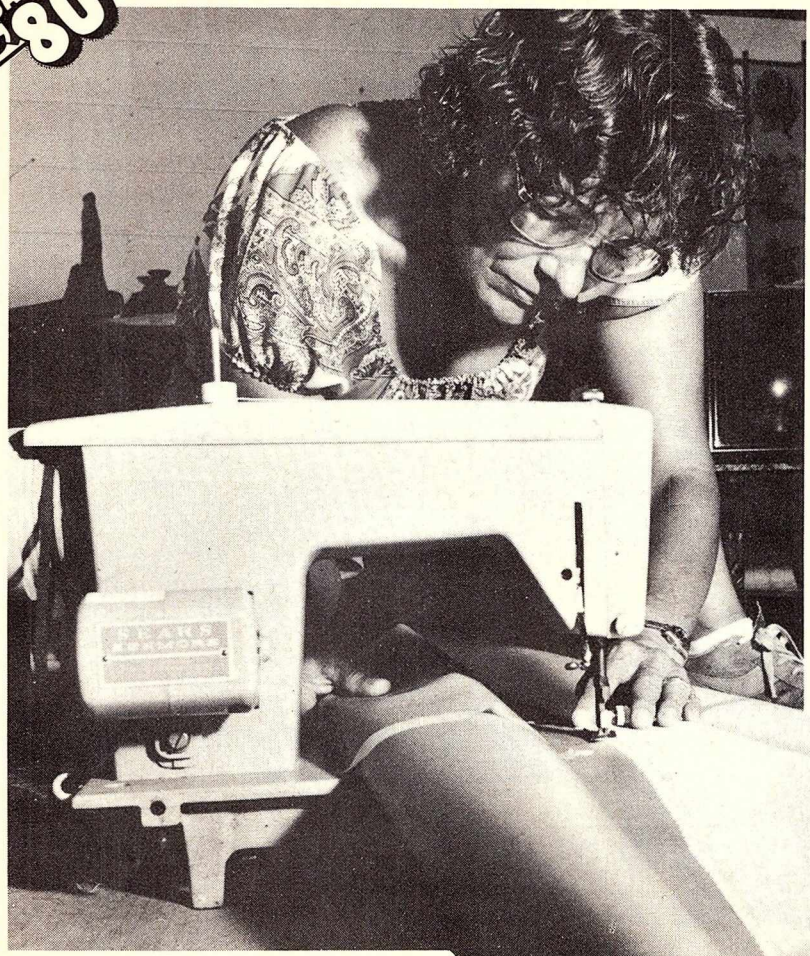
Basically, the 145 DTS is pure Renault, made in France by that firm which has been building cars since the 1890s. It's the result of a deal between Mercury and Renault that lets Mercury take Renault-built blocks and marinize them in Mercury plants here, then sell them out of the Mercury marketing system. Mercury fits MerCruiser sterndrive units to the engines or delivers them for conventional inboard installation.

(Continued on page 133)

BOATING '80

A SAIL YOU CAN MAKE FROM A KIT

By Hal Kelly



PORTABLE sewing machine can easily handle the job of making a homemade sail. But practice first on scraps from kit.

Would you believe . . . you can buy a kit that lets you make your own sail.

BACK in 1975, we built a boat called AquaPram. We built the boat as a project for Mechanix Illustrated readers and offered plans for the vessel.

AquaPram was a small boat, only 8 feet long, and intended to be powered by a little outboard. But after we'd had her awhile we decided to try out a sailing rig on her. So we began looking around for a sail.

We hadn't been looking long when one day we came across an advertisement for a sail you could make from a kit. It was from an outfit in Indiana and for $1 they were offering a catalog of different sails you could make from their kits. The address was Sail Kit, Columbia City, Ind. 46725, and we sent them a dollar.

SAIL made from mail-order kit can be put together in about 10 hrs. It holds wind as well as any store-bought sail.

First thing you know, here comes the catalog in the mail and it turns out they are offering a considerable range of sizes and styles of sails. We picked out a lateen type, a bit smaller than a Sunfish sail, and sent in our order along with a check for $37.65.

In return we received a drawing that showed how the sail was to be laid out and sewed, 6 yards of 4-ounce nylon sail material (red & white), 2 ounces of silicone adhesive, 6 tubes of V-46 thread, a grommet kit, 20 feet of 3-inch luff and foot tape and a manual on the

FORD'S EXCLUSIVE CLUB ROOM

1980 Ford Captain's Club Wagon. Best EPA gas mileage rating of any van. Station wagon luxury—much more room.

Here's one exclusive Club everyone can easily enter! Ford's advanced Club design means more move-around room for driver and plenty of inside passenger comfort. Built tough: Separate body-on-frame construction, rugged Twin-I-Beam suspension. See your Ford Dealer. And ask about Ford's Extended Service Plan.

BEST VAN GAS MILEAGE

18 EPA EST.* **26** Hwy. EST.*

Built Ford Tough

*300 Six, optional 4-spd. manual transmission. Compare these estimates with others. Your mileage may differ, depending on speed, distance and weather. Actual highway mileage will probably be less than estimated. California estimates lower.

Welcome inside the Club. Ford's Captain's Club Wagon comes with fold-out snack/game table, four recline/swivel chairs, and seat/bed.

Combination seat/bed. Folding rear seat turns Ford's Captain's Club Wagon into a mini camper.

Super wagon size, too! Ford wagons offer seating plans for four to 15 passengers. And Ford Club Wagons offer light- and heavy-duty Trailer Towing Package options.

FORD

FORD DIVISION Ford

For Home-Apartment-Business

Magnetic water treatment device

(for under $100)

A unique application of an old technology used in the Soviet Union for over twenty-five years.

mr.Goodwater is a "conditioner," not a filter or purifier.

WHAT IT DOES

mr.Goodwater is designed to accomplish what no water softener or filter can. mr.Goodwater removes nothing from the water, but it does help to eliminate the undesirable effects of hard water.

This remarkable invention not only helps to remove lime scale deposits already existing in your water systems, but continues to help prevent new deposits from forming.

mr.Goodwater will help cut down the hard lime deposits (ring) around the tub, shower, faucets, swimming pools; helps prevent spotty dishes, too.

mr.Goodwater will help provide your entire home or business with a steady, uninterrupted supply of tastier, more drinkable water — especially good for: coffee, juices, soups and desserts, cooking, low salt diets — even makes good ice cubes.

HOW IT DOES IT

The secret is in its magnetic core. The unit is a powerful, permanent, ceramic, double-pole magnet. Ceramic magnets retain their strength indefinitely without any outside power source, ever.

mr.Goodwater creates what we call a "magnetic force field." When water passes through this "magnetic force field," scale forming minerals in the water are physically changed to a purgeable material which is held in suspension and easily rinsed away. This unique magnetic treatment process not only helps soften and rinse out existing lime scale deposits, it also helps prevent any future buildup of scale in home and industrial water systems.

Most water treatment devices are a chemical-switch, altering minerals with sodium. These devices that use sodium chloride (salt) are not recommended for people with high blood-pressure or weight problems. The salt from these devices is also harmful to lawns, plants and pets, aquariums, etc.

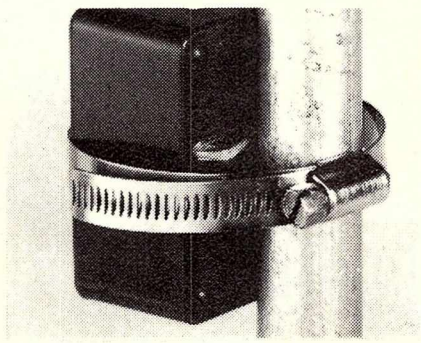
mr.Goodwater is an external device, helping to eliminate the problems salt solutions cause, yet providing you with the benefits of treated water.

Amazing? Yes, even more astounding is the fact that the Soviet Union has been using the magnetic treatment of water for over twenty-five years.

SAVES ENERGY

Energy savings is of increasing importance to all industrial, business and home users of water. Without mr.Goodwater, your water heater and boiler might be wasting precious energy dollars by attempting to heat through a natural barrier of calcium insulation. This same "scale" buildup can cause expensive energy and labor costs to you by appearing in dishwashers, coffee makers, ice machines, car washes and everywhere water flows.

IT IS SIMPLE TO INSTALL



Think of anywhere water is being used . . . and you've thought of another good reason for mr.Goodwater.

No cutting or rejoining of pipe is required for most installations. mr.Goodwater is merely placed on your pipe as fully explained in the easy-to-follow instructions and held in place with a strong stainless steel clamp. All you need is a screwdriver, and in a few minutes you will have mr.Goodwater-conditioned water. Be patient; things get better with time.

mr.GOODWATER WARRANTY

Although each mr.Goodwater unit comes with a one-year limited warranty, chances are it will last as long as you keep your home or business because there are no working parts to wear out. You can also take it with you when you move. If you are not completely satisfied, you may return the unit within 30 days from the date of purchase for a complete refund.

To order your mr.Goodwater water conditioner, send $69.95 plus $3.00 for postage and handling to the address below. Credit Card buyers may call our toll-free number below. We will send you your mr.Goodwater water conditioner with warranty and full instructions for simple installation.

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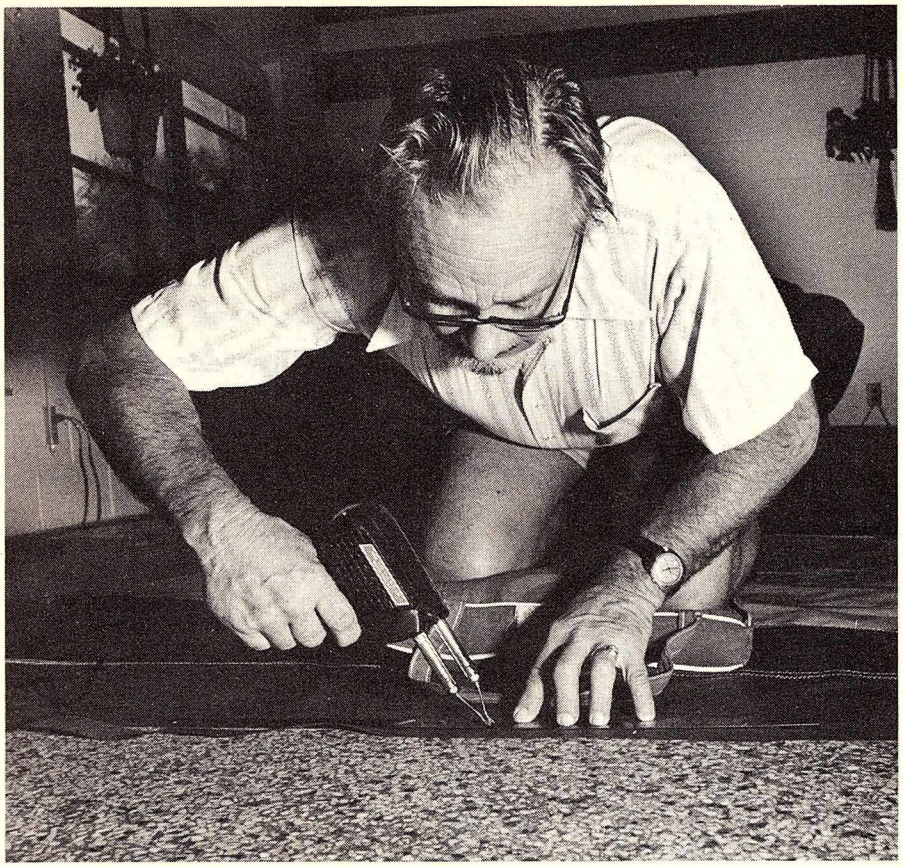
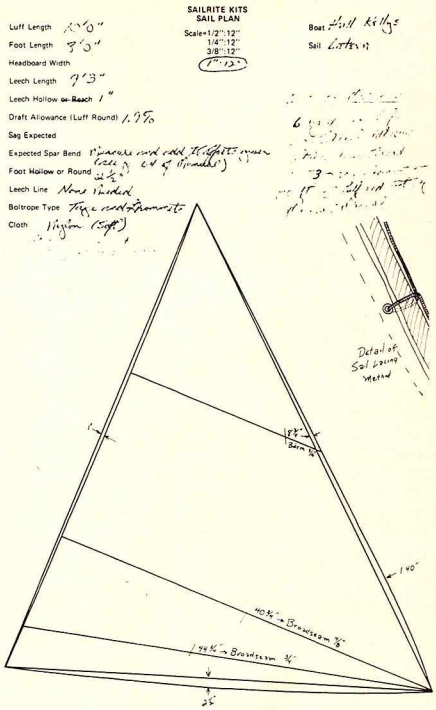




PLANS (above) are easy to follow. Kit also includes a booklet on sail making. Soldering gun (left) with hot knife cuts nylon sail to shape. At same time, its heat fuses edges so they won't unravel.

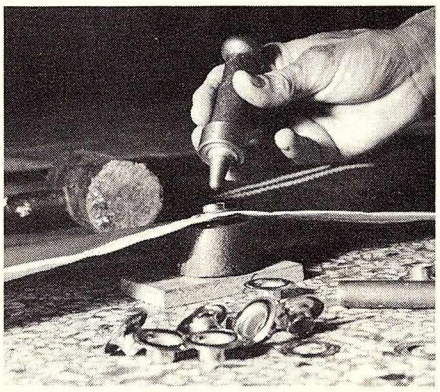
fine art of sail making in general.

We used our living-room floor to lay out the sail. Since the sail is trimmed with a hot knife, you use a piece of glass slipped between the sail and the floor to cut on to keep from ruining the floor. A piece of glass 11×14 inches does the trick. Just move it along as you trim.

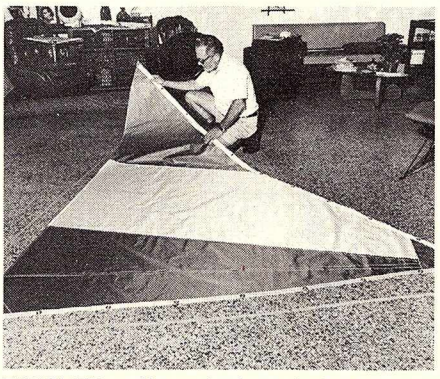
Mark the triangular sail plan on the floor with a chalk line to get the general shape. Then use ¾-inch masking tape to mark the final shape. The sail material is 42 inches wide. Lay it over the tape pattern, overlapping it about ½ inch. Then rough-cut the material to size with a pair of scissors.

With it rough-cut, glue the seams and broadseams temporarily with the silicone adhesive. This little trick is what takes the headache out of sail making at home. Make the broadseams (the edge seams) in smooth curves along the edge of the panels. The broadseam is what gives the sail a cup shape to hold the wind better. When this flexible glue dries it holds the sail together for easy sewing with no wrinkles. And it doesn't gum up the sewing machine.

We used our little zigzag home sewing machine. You have enough



GROMMETS go in last, after sail has been sewed together. They are spaced 10 in. apart along edge at the luff and foot.



FINISHED sail ready for wind and sea. Author assembled sail in living room, since material was only 42 in. wide.

scraps to practice on, and you should practice. In testing, we found that our little machine would sew through ten layers of 4-ounce nylon. Our machine was a portable that we had mounted in a sewing table. But we took it out and put it on the floor.

Put the sail over the pattern and trim to final shape. We used a hot knife we bought for our soldering gun. Although the outside edge of the sail has a slight curve, you can still work this curve with a metal straightedge and get a better job than doing it freehand.

The hot knife not only trims the sail but fuses the edge so it doesn't unravel. Reinforce the corners with nylon and start sewing. The leach edge is sewed first, then the luff, then the foot. Put in the grommets last.

Total time for the job is about ten hours. If you do more than one, the second one can be done in about half that time. A lot of time is spent learning from the manual.

You sure learn a lot about sail making from this project. This is a good sail size to practice on. After making this little sail you could tackle a 400-foot mainsail. The only thing that would limit the size would be your floor area.●

THE MAKING OF A MAST

By Genevieve Brooks Russell

They needed a replacement mast for their older boat . . . so they made it themselves!

WE WEREN'T surprised to find the hole in the mizzenmast when we bought our 1942 sailboat. What did surprise us was that the mast was still standing. The hole was big enough to put your fist through it and about 3 ft. long. So we decided to scrap the mast and build a new one.

The first step in building a new mast was doing research so we'd know what we were up to. We finally decided on a solid mast of mahogany laminates. Mahogany, though not the very best mast material, is still reasonably good for the purpose and readily available in clear lengths at a reasonable price in most areas.

The new mast was to be an exact duplicate of the old one so all the rigging could be just switched over. It was 38 ft. long and 6 in. in diameter at the base, with the top third tapering to 4 in.

First, we drew a 6-in.-diameter circle on graph paper and divided it into eight ¾-in. sections representing each laminate. This gave us the width of each laminate. We bought the mahogany, ripped it to width and air-dried it over the winter. We recorded the length of each plank and marked it on the plank edge.

Then, on a large piece of graph paper, we sketched the planks so their scarphs (angled joints) would not be near each other in the eight layers. Each plank was assigned a layer and position.

(Continued on page 128)

BENCH of crosspieces and stakes driven into the ground holds mast as we put it together. First we applied glue between the laminates. Then we clamped laminates with threaded rods.

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Private First Class Brian Patterson,
98th Regiment, 4th Brigade, 98th Division (Training).

MEET TODAY'S ARMY RESERVE.

A BOAT FOR ALL SEASONS

By Bob Whittier

Its name is john, and—a kind of pickup truck of water craft—it's about the most useful, practical small boat ever invented.

JOHNBOAT? Nobody seems to know where the term comes from. But many boatmen are starting to enjoy the boat. It's a flat-bottom craft that's as simple as it is utilitarian. And it's as modern as it is reminiscent of bygone days.

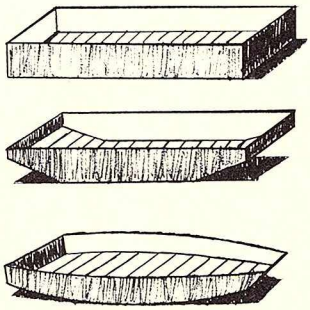
Usually made of aluminum and squared off, the johnboat ranges in length from 10 to 20 feet. And some models carry whopping loads, making them the boating world's equivalent of pickup trucks.

Today's aluminum johnboats didn't just happen, though. They're the outcome of a long and interesting history. You may have heard the term *Ozark johnboat*, from which you'd guess that the design originated in the Ozark Mountains. Well, in some respects it did, in others it didn't.

During WWII, many firms in the American midwest sprang up to subcontract for the huge airplane factories that supplied our armed forces. When the fighting ended, they looked around for civilian products that could be made on their sheet-metal forming equipment.

Some of the factories in Missouri

(Continued on page 133)



SONOFAGUN. Those Ozark Mountain men had some fun on the bayou. They whiled away their lazy leisure hours making float trips in wooden johnboats, sipping Coke and trying to catch a bass or two. Poles or paddles were used to maneuver the low-sided craft since oars tended to get in the way. At right, the early wooden johnboat is shown in three stages of development. On top, the simplest rough-hewn boxlike craft could be made easily by men with experience in building feed troughs for their farm animals. Middle sketch shows how the ends and center were made scow-style to ease mobility. And lastly, flared sides and a rockered bottom improved the johnboat's forward motion and pivoting.

SOME LEADING ALUMINUM JOHNBOAT MANUFACTURERS

Alumacraft Boat Co.
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Eldo Craft Co. Inc.
Box 40, Smackover, Ark. 71762

Fisher Marine Inc.
Box 1256, West Point, Miss. 39773

Lowe Industries Inc.
Interstate 44, Lebanon, Mo. 65536

MonArk Boat Co.
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Polar Kraft Mfg. Co.
Box 708, Olive Branch, Miss. 38654

Rhyan-Craft Boat Mfg. Co.
1700 S. Jackson, El Dorado, Ark. 71730

Landau Boat Co.
1015 N. Jefferson, Lebanon, Mo. 65636

Meyers Industries
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ALL CARTRIDGES NOW AT ABOUT HALF PRICE! For brief description of all cartridges, see order form at right. IMPORTANT! Orders for cartridges must be placed at same time as order for VideoBrain computer console. We can NOT guarantee availability of cartridges at a later date!

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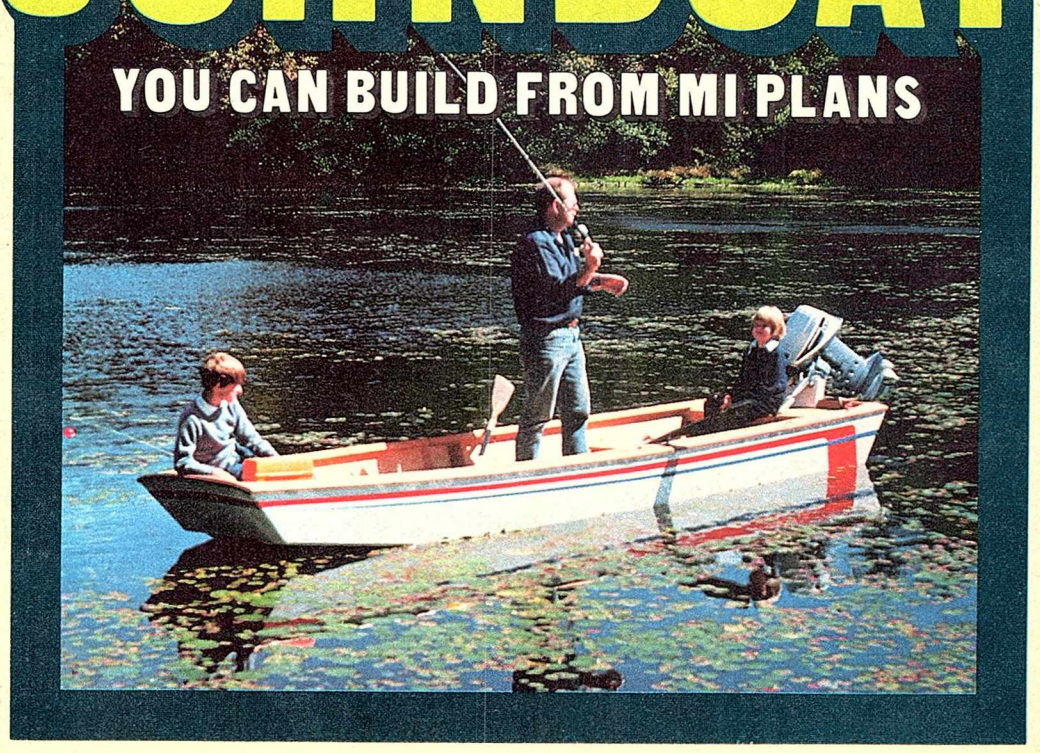
GREAT LITTLE JOHNBOAT

YOU CAN BUILD FROM MI PLANS



By Bob Whittier

A time-tested design, the johnboat is fairly simple and inexpensive to build, and makes an interesting do-it-yourself project.

OLD wooden johnboats, built for use on Ozark streams, were often roughly made craft. Put together on the cheap, they might last only two or three seasons. The wide boards on the sides often developed longitudinal splits. And the boards on the bottom were put on with slight spacing to allow for soaking and expansion. Thus, they leaked before swelling tight, and thereafter were kept tight by being left in the water.

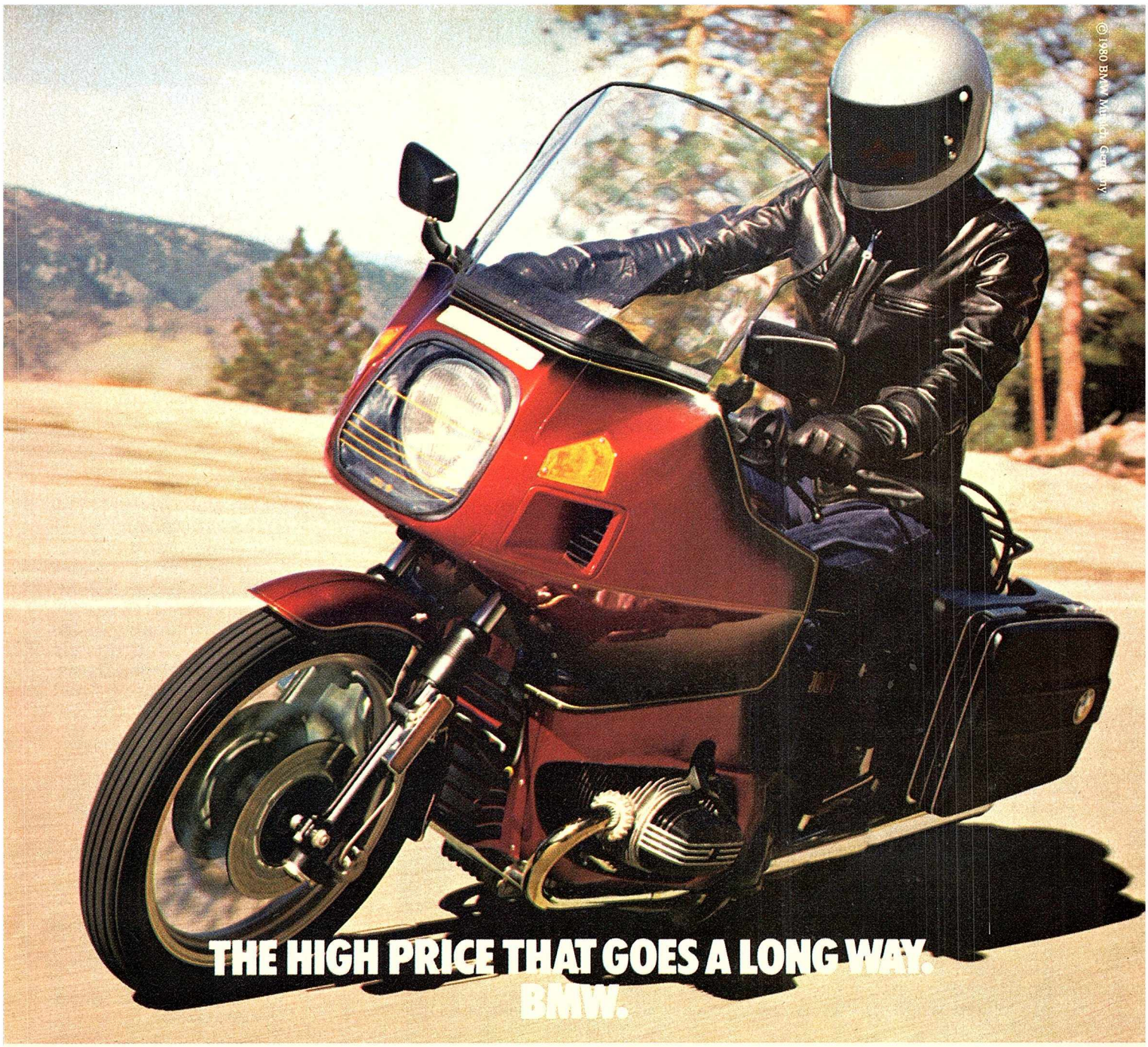
MI's johnboat meets modern requirements. It is higher in the sides to make it seaworthy on lake waters. And it's wider in beam. If you want it narrower to fit between the wheel wells of a vehicle, simply deduct a few inches from the frame half-breadths.

IT REALLY is more efficient just to go buy an aluminum johnboat these days. But if for some special reason you need a wooden one—or just would like to build a wooden boat—MI's johnboat is a good project.

One reason old-time johnboats were low-sided was that sound boards more than 12 or 14 in. wide were hard to find. MI's johnboat is planked with plywood, so side height is not limited. It's 15 to 16 in. high.

We made our johnboat 15 ft. 8 in. to take advantage of stock 8-ft. plywood. We set the central seat amidships for good balance when rowing alone. And we provided oarlocks for the forward seat so an oarsman can sit forward to balance a passenger in the stern.

Johnboats are unusual in that they can be easily modified in length and/or width using the original plan. If you want it longer, just increase the spacing between frames—or vice versa. Just make



How do you weigh your pleasures of the road? By the pound? Or by the mile?

If it's by the mile, this BMW R100 RT represents a lightweight, roadworthy plateau in bike riding. Admittedly high priced but, in the long run, very economical.

Unique BMW benefits. Its distinctive, instantly recognizable integrated fairing, unlike "add-on" fairings, is designed to be part of the total bike — its weight distribution, suspension, even its braking characteristics. This amounts to a mighty road advantage in itself.

The luster of this BMW R100 RT's hand-striped, hand-"smoked" finish is obvious. The high temperature method that helps keep it lustrous is not.

Nor are the many other luxuries, such as BMW's custom designed saddlebags that are standard with this R100 RT.

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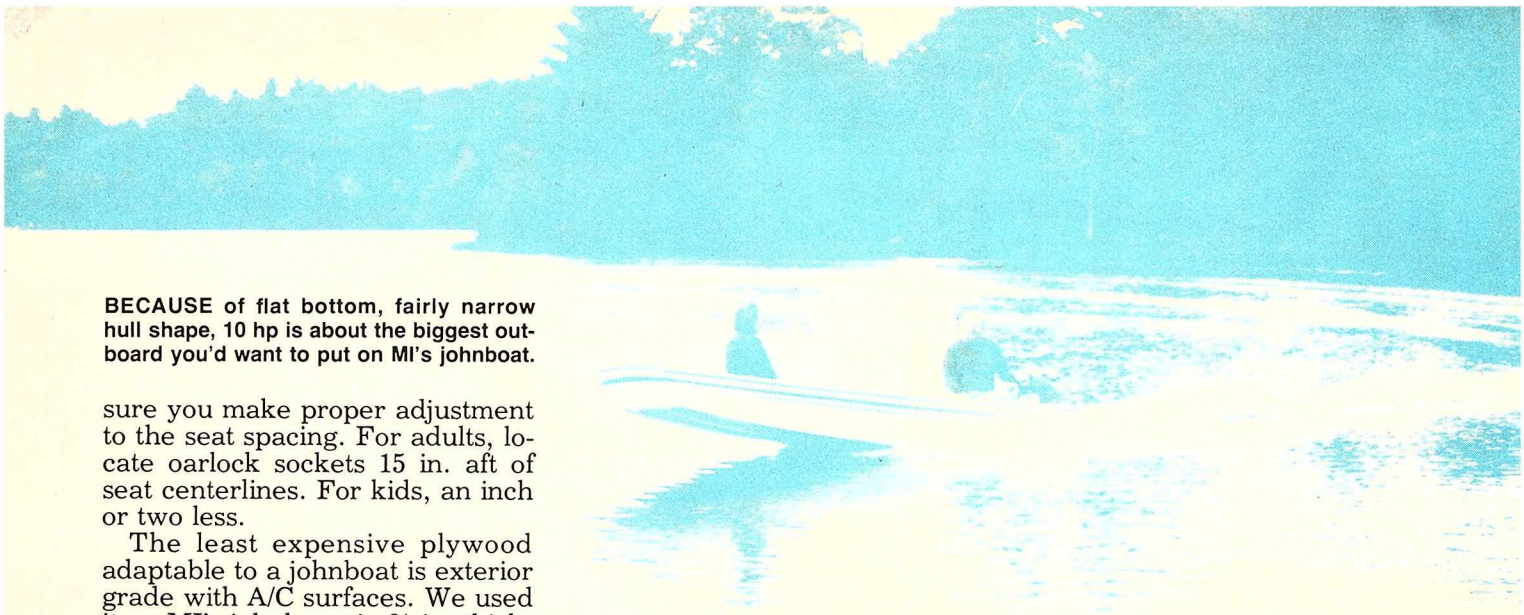


BECAUSE of flat bottom, fairly narrow hull shape, 10 hp is about the biggest outboard you'd want to put on MI's johnboat.

sure you make proper adjustment to the seat spacing. For adults, locate oarlock sockets 15 in. aft of seat centerlines. For kids, an inch or two less.

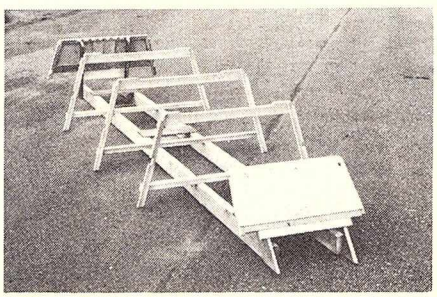
The least expensive plywood adaptable to a johnboat is exterior grade with A/C surfaces. We used it on MI's johnboat, in ⅜-in. thickness in three plies, available at any lumberyard. We put the A surface inside.

After we cut the pieces to fit onto the frame, we set them on edge. This common grade of plywood has voids between adjoining veneers. We taped over the lower ends of the voids and poured activated fiberglass resin into their upper ends until each void was filled with resin. This simple trick makes the wood acceptable in spite of the voids.

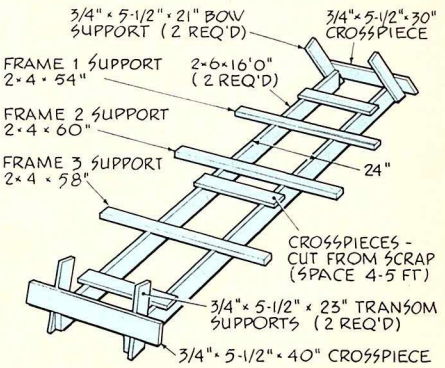
We fiberglassed our finished johnboat to seal the fir plywood against weather-checking and to give better abrasion resistance to the bottom. The completed boat weighs 285 lbs., which is a hundred or more pounds greater than an aluminum craft of equivalent size. In the summer of 1979, the material cost $400. Since the fiberglass insulates them from the water, we economized by using common bright plated wood screws. Allow about 80 hrs. to build the boat.

Ten horsepower is the most power this boat can safely take. We tested her with a 9.9-hp Evinrude. With two aboard it planed out easily and did around 20 mph. For short-distance use as a tender or pond fishing boat, a 2- or 3-hp outboard pushes her faster than you can row. A 3½-hp single-cylinder motor would pep her up noticeably while keeping cost down, but it would not plane her. Most efficient may be about 7½ horses.

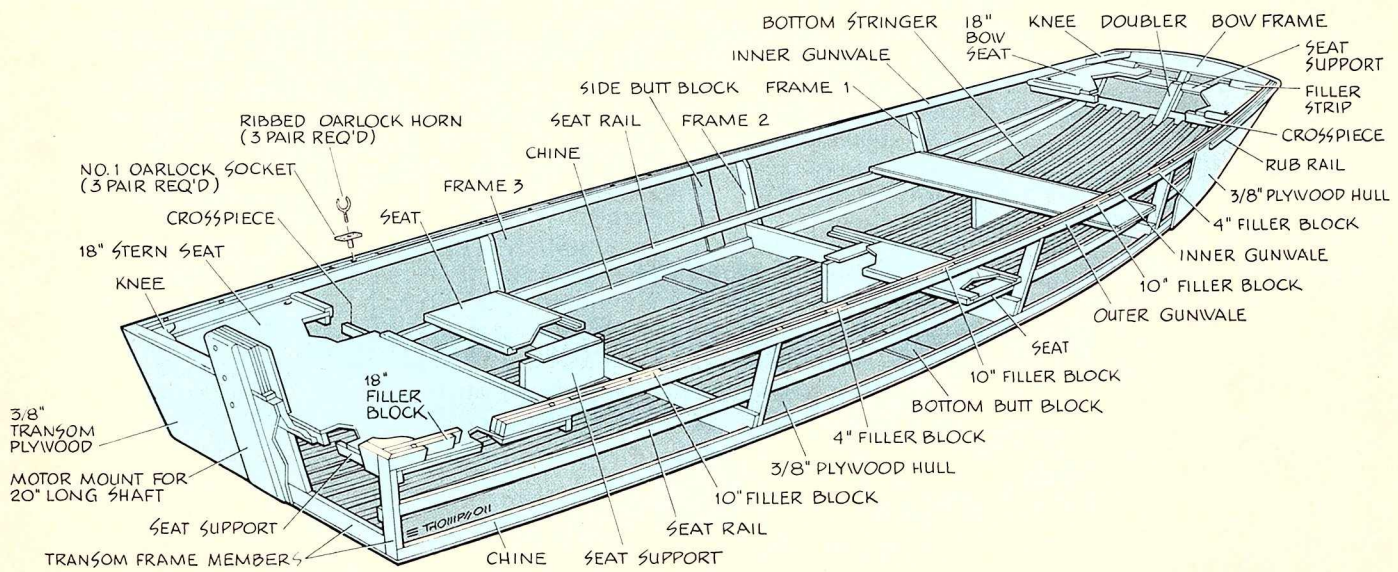
We used Douglas fir porch flooring for the framing. It is readily available, of uniform quality, holds glue and screws well, is adequately strong, has acceptable rot resistance in a well-ventilated open



JIG. Use very sturdy, solid planks for frame on which you build boat. Otherwise the hull twists, you get a misshapen boat.


3/4" x 5-1/2" x 21" BOW SUPPORT (2 REQ'D)
3/4" x 5-1/2" x 30" CROSSPIECE
FRAME 1 SUPPORT 2 x 4 x 54"
2 x 6 x 16'0" (2 REQ'D)
FRAME 2 SUPPORT 2 x 4 x 60"
FRAME 3 SUPPORT 2 x 4 x 58"
24"
CROSSPIECES - CUT FROM SCRAP (SPACE 4-5 FT)
3/4" x 5-1/2" x 23" TRANSOM SUPPORTS (2 REQ'D)
3/4" x 5-1/2" x 40" CROSSPIECE

JIG ASSEMBLY



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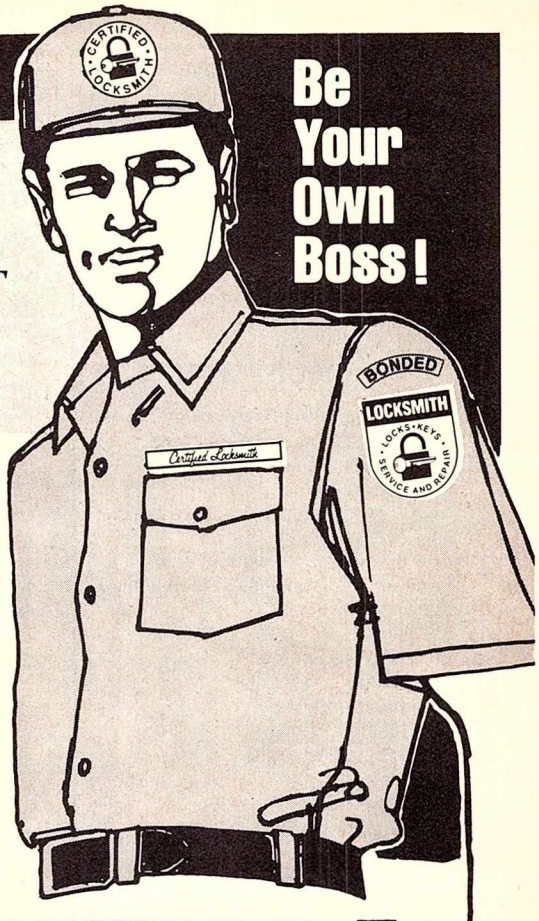

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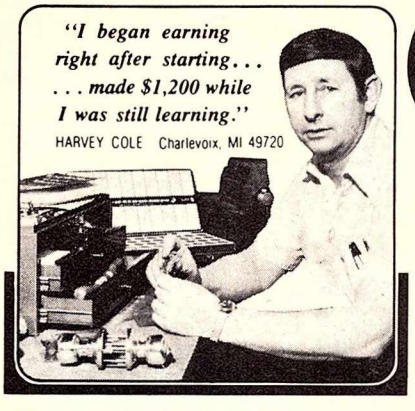

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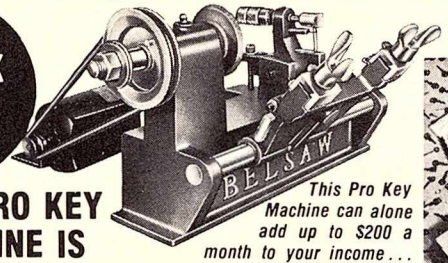

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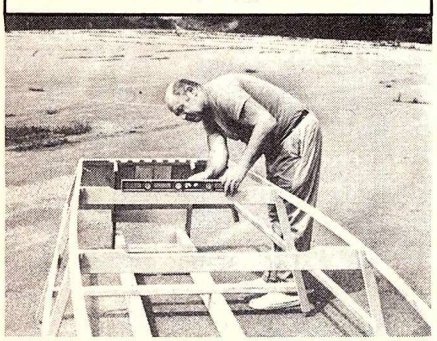
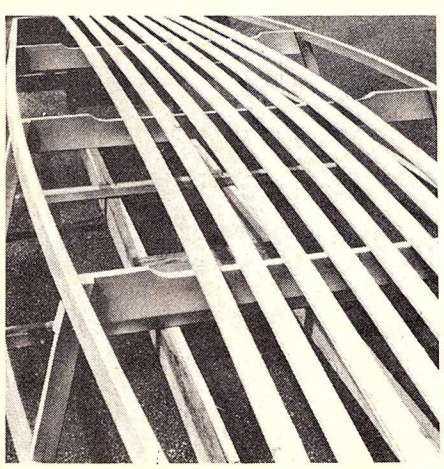
BILL OF MATERIALS

- 4 sheets ⅜-in. plywood (4x8 ft.).
- 1 sheet ½-in. or ⅝-in. utility plywood.
- 6 pcs. ¾x3½-in. Douglas fir porch flooring × 16 ft.
- 8 strips ¾x1¾-in. pine x 16 ft.
- 1 pc. hard pine or oak ¾x3½-in. x 16 ft.
- 2 pcs. half-round gunwale molding x 16 ft.
- 1 box ¾-in. No. 8 flathead wood screws.
- 3 boxes 1-in. No. 8 flathead wood screws.
- 2 boxes 1½-in. No. 8 flathead wood screws.
- 1 box 2-in. No. 8 flathead wood screws.
- 12 tubes Phenoseal or equivalent.
- 1 lb. Weldwood glue.
- 2 qts. wood preservative.
- 6 ¼x3½-in. galvanized carriage bolts.
- 1 bow eye with ⅜-in. shank.
- 4 or 6 (to suit) oarlock seats and oarlocks with stainless steel machine bolts.
- 1 gal. varnish.
- 2 qts. fiberglass primer.
- 2 qts. marine undercoater.
- 2 qts. marine enamel.
- 5 gals. fiberglass resin.
- 10 yds. fiberglass cloth.
- 1 gal. acetone.
- 1 small can auto body putty.
- 2 2x6-in. planks x 16 ft. (for jig).
- 2 2x4-in. x 10 ft. (for jig).



MAKE copious use of spirit level, string and square. Notice how the transom is notched at 45° to mate with stringers.



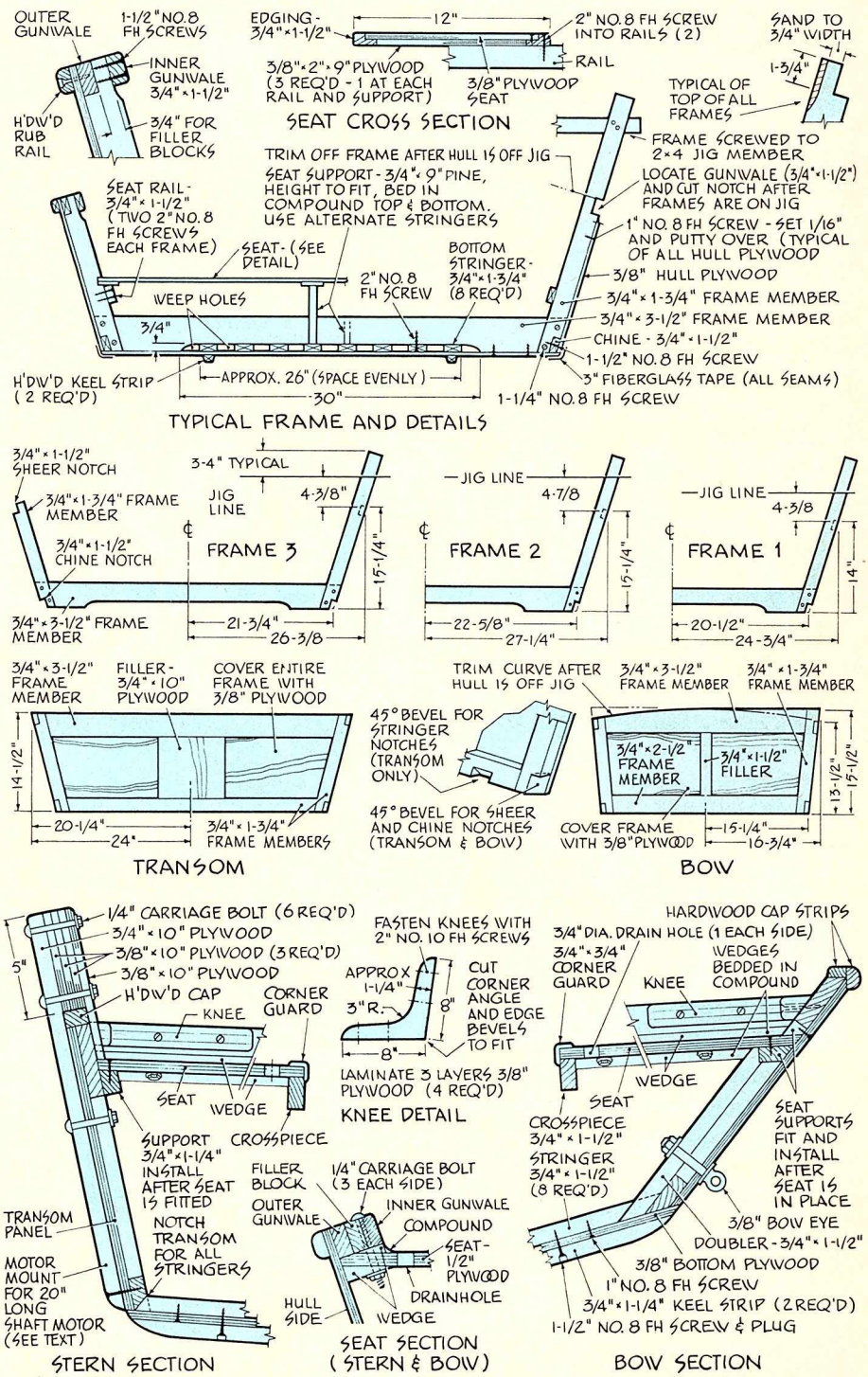
EIGHT bottom stringers need not be of especially strong wood. Bottom planking panel fits over these, acting as a gusset.

boat like this and is moderate in weight. It has a tendency to splinter, so use very sharp saws with small teeth and set your plane to take small shavings off on each stroke. Other woods can be used, too.

Make the three frames and the bow and transom panels first. The right and left sides of each frame are identical. Make the upright members of the frames by ripping a piece of 1x4 (nominal) down the center. Use Weldwood or other waterproof, hard-setting glue on these members because rigidity is desired.

Choose straight, firm planks for the jig. Easily flexed wood leads to trouble. When installing the sloping uprights at the ends of the jig—which hold the bow and transom panels—make sure both have the same angle.

The top and bottom sides of the bow panel are made with extra-wide top and bottom pieces. These project somewhat beyond the ply-



wood itself. This allows a surplus, so these edges can be planed to the appreciable angles they must have due to the bow panel's appreciable slope.

Attaching the frames to the jig, use a tight string to get the centerline marks all on the same straight, true line. Use carpenter's level and square to assure each part is attached accurately.

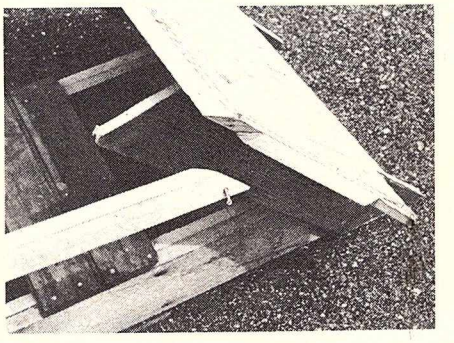
The notches in the frames for the chine stringers (where bottom and sides meet) can be sawn before putting the frames on the jig. But it is best not to cut those for the gunwale stringers until the frames and chine stringers are in place. Then clamp the gunwale notches temporarily in place. Then mark and cut them.

At the ends of the stringers you do not make square notches. Rather, you saw the ends off at a 45° angle, going by eye. Then rasp mating notches in the bow and transom, and fit the stringers into these.

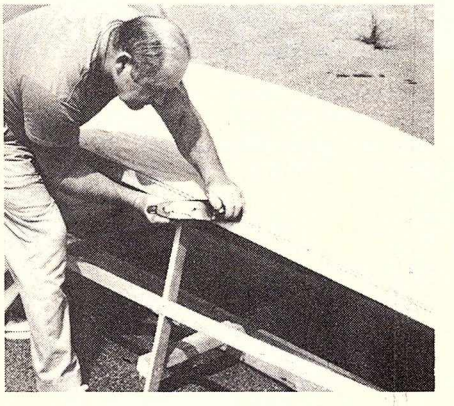
Most wood glues (except for costly epoxies) require a smooth wood-to-wood contact. As this kind of work is too fussy here, the resulting gaps are filled with brittle glue that later cracks as the boat flexes. But these problems vanish when you use an adhesive bedding compound.

We used Phenoseal. It comes in caulking-gun cartridges. While uncured, it is easy to mold onto fillets and into voids, etc. It cures to a tough, rubberlike consistency that clings and holds parts together well, yet gives but doesn't crack under stress.

The eight bottom stringers need not be of any especially strong wood. Pine is all right. Just don't get large knots in the forward portions where there is the most bending. The aft ends are cut at 45° and fitted into matching 45° notches made in the bottom of the transom. The forward ends are sawn to fit against the bow piece, no notching required. It's best to make the forward cuts first, nail the stringers temporarily in place, then bend them onto the frame and mark them at the transom for cutting to length.



NOTICE how chine stringers notch into corners of the bow piece and transom. Use galvanized screws and bedding compound.



BIGGEST pain in boat building is planing all the little lumps and rough spots so that mating surfaces fit right and true.

Small screws or galvanized nails are adequate to hold these stringers to the bow and transom. The plywood plus the adhesive bedding compound take up stresses. Think of the plywood as one overall gusset that ties the frame members together.

When the frame is finished, apply a straightedge to all parts where plywood will touch it. Take down any high spots and fill low spots with glued-on wooden shims. Try for smooth and uniform contact between plywood and frame.

Lay a panel of plywood on the

(Continued on page 117)

FIBERGLASS SUPPLIES

It is expensive to buy fiberglass materials. You can usually get the best deal by mail-ordering from specialty firms. Here are some prominent ones.

Boat Armor
One N. Water St., St. Paul, Minn. 55107

Defender Industries Inc.
255 Main St., New Rochelle, N.Y. 10801

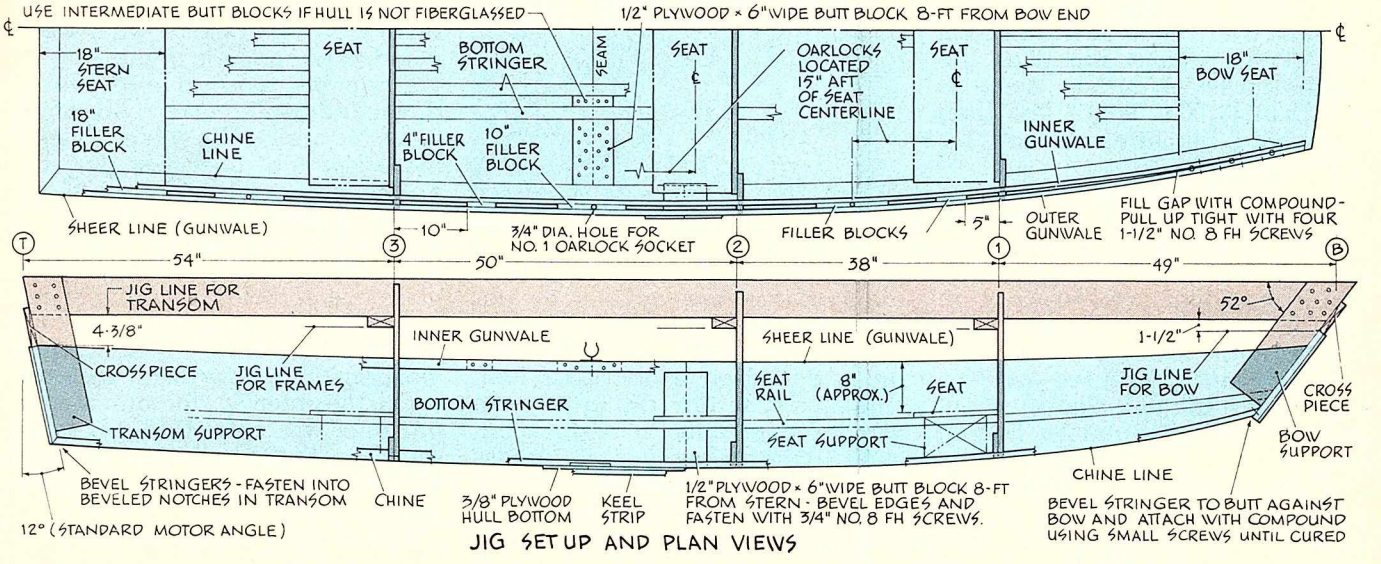
Fibre Glass-Evercoat Co.
6600 Cornell Rd., Cincinnati, Ohio 45242

Kristal Kraft Inc.
Box 787, Palmetto, Fla. 33561

Kick-Shaw Inc.
3511 Hixson Pike, Chattanooga, Tenn. 37415

Glen-L Marine
9152 Rosecrans, Bellflower, Calif. 90706
(They also have an excellent book, How to Fiberglass Boats.)

Dunbar Marine Specialties
Box 531, E. Longmeadow, Mass. 01028



JIG SET UP AND PLAN VIEWS

FIXING UP AN OLDIE BUT GOODIE

By Jack Wiley

One way to get the boat you want at a low cost is to buy an oldie but goodie and fix her up.

BUYING *used* instead of *new* has always been a good way to get a good deal in a boat. And—frequently—an even better way to get the most boat for the least money is to recondition a neglected or even damaged boat.

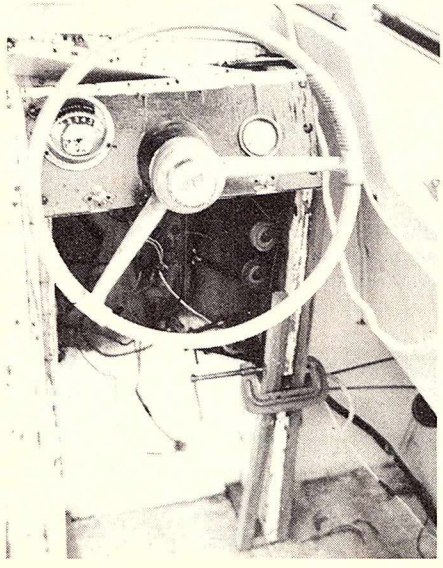
Recently, we did that. We purchased a badly neglected, slightly damaged 17-foot Dotline cabin cruiser for $600, including a 75-hp outboard and trailer. Working in a small area beside the house in a trailer park, we reconditioned the boat, engine and trailer in spare time over 6 months.

And it was a good deal. The total cost of the project, including the original price of the rig, came to less than $1,000. That's less than half what a similar combo sells for on the market.

And besides saving money, we were able to modify the boat to fit our needs more closely. We planned to use the boat for vacation living-aboard and cruising on the California Delta. So we added a cabin table that lowers to form a second berth. And we added a galley with sink and alcohol stove, and portable toilet under a fold-up seat.

When looking for a boat to restore, keep in mind that, unlike wood, fiberglass doesn't rot. So a fiberglass boat that has had little maintenance can usually be put back into first-class condition. Major damage usually can be repaired much easier on a fiberglass boat than most minor damage on a wooden one. Thus, in restoration, stick to fiberglass vessels unless you have a good, specific reason to get involved with a wood.

NEGLECT can bring down the value of a boat pretty fast. But if the vessel's fiberglass and you know what you're doing, you can end up with a great rig at low cost.



Neglected boats are often difficult to sell. So you can be in a good position to bargain for a low price. We paid less than a third what a similar boat in good condition would sell for.

Try to do the work close by where you live. Inside or under cover is best, but many projects can be done in the open. A canvas cover can be used to keep the boat fairly dry during rainy weather. Renting space in a do-it-yourself boatyard can be okay, but it increases your costs and may be far from home.

We began reconditioning by stripping the boat down. All loose equipment was removed. Then we stripped two layers of carpet from the cockpit and cabin soles, and a layer of paneling and a layer of carpet from the main bulkhead. You find that many old boats have layers on layers like this. Over wood, it often leads to dry rot.

Then we sanded everything down and beefed up the fiberglass in weak areas. We added one or more layers of fiberglass over the entire cabin and cockpit soles, which formed the upper layer of a double hull and had been leaking. We used polyester resin and fiberglass mat and cloth. Critical in getting a good bond is rough-sanding areas to be fiberglassed, then washing them down with acetone.

On the interior, for our modifications, we attached plywood members to the hull by using strips of fiberglass mat, as is typically done in the factory.

The hardest repair on our boat

was the keel, which had been damaged by the rollers on the boat trailer. Fiberglassing a floor or even a vertical area is one thing. Overhead is another. And the area underneath the boat with the boat on the trailer gave little room to work. We used a special thick resin, readily available, so it would bond the fiberglass mat and cloth overhead without too much of the resin draining off.

To beef up the transom, we needed to remove the 75-hp outboard. So we purchased an old swing set at a junkyard for a couple of dollars and made an engine stand and hoist from it. Or we could have rented an engine hoist, available in our area at a cost of only $8 per day.

After reinstalling the engine, we cleaned it, then tuned it ourselves by buying a tune-up and repair manual for that particular engine which gave detailed, step-by-step instructions.

We looked in junkyards and surplus and thrift stores for building materials and accessories. Aluminum frames from shower stalls provided the frame for the cockpit windshield. And we bought 500 square feet of vinyl-covered canvas at a thrift store for $30. From this we made curtains and covers.

Reconditioning a boat trailer is fairly easy. Do it with the boat on the trailer, or launch the boat or block the boat up and pull the trailer out from under.

We added extra channel steel to our trailer with the boat still on it. We had a welder come out with a portable rig for $25 an hour. The job was done in an hour.

Other reconditioning we did included repacking the wheel bearings, replacing the rubber boat rollers with carpeted slide boards and scraping, wire-brushing and sanding and painting the metal parts of the trailer. ●

Pseudo-Oils
(Continued from page 45)

that low number, the less burden on your engine.

Now conventional oils are being formulated in lower viscosities, too, and have been getting all sorts of friction-modifying ingredients to make them more slippery. Arco-Graphite, a thin, premium oil with graphite suspended in it, is one example of this new breed of gas-saving oils. But these thin oils still suffer from the problem of thickening due to oxidation. They stay slippery, thanks to certain special additives, but they can't perform as well as a similarly treated synthetic.

But if the stuff works so well, why, you may ask, aren't there more big-name synthetics on the market? And why doesn't every car come off the assembly line with the stuff already in it?

The first and biggest reason is cost. Synthetics are still pretty expensive.

But despite the expense, the carmakers are beginning to take an interest in gas-saving lubes. Don't be surprised to see partial synthetics in cars coming off the assembly lines by the mid-'80s. As a matter of fact, the fellows in Detroit are already recommending lighter oils, like 10W-30 instead of 10W-40, especially for use in smaller engines. In not that many years, that 10W-30 will be down to 5W-30; all in the name of more miles per gallon.

However, there still aren't enough facilities or resources around to make all the synthetics that would be needed.

What we're probably going to see are mixtures: an engine lubricant that's 80 to 90 percent selected grades of high-quality oil and 10 to 20 percent synthetic. That way we'd end up with an oil that's got about a 5W-30 viscosity rating and would hold that viscosity longer than straight oil. There are some on the market now. Kendall Synthetic Fortified is one. It's 70 percent oil and 30 percent PAO.

But if you decide to go all-synthetic now to improve your car's mpg, there are few things to look out for. The first is that the lube meets your car's warranty requirements. To be sure that the lube you're buying actually has been tested and approved (don't believe everything you read on the can), write the company that sells the stuff for a copy of the test results.

Another tip: Synthetic lubes already have all the additives the engineers think they need, so don't add a pint of Grandpa's Special Motor Honey. All you'd do is thicken the stuff and negate the whole idea.

And remember, synthetics are more slippery than oil. If you put some in an old clunker that runs terribly and leaks here and there, it'll still run poorly. And the lube will leak out a whole lot quicker. ●

Build MI's Johnboat
(Continued from page 115)

bottom, clamp it temporarily and mark it by running a pencil along the chine stringers. Leave about ¼ in. surplus when cutting, which you plane off after the plywood is permanently in place.

After trimming, make pencil lines on the outside of the plywood to indicate the centerlines of the eight bottom stringers. Using a Screw Mate (or something similar), make pilot holes about 24 in. apart and put a few screws into the chines and stringers to hold the plywood against shifting. Then make the remaining pilot holes.

Space screws 8 to 10 in. along the chines and stringers. Remove the temporary screws and apply a ⅛-in. bead of adhesive caulking compound along mating surfaces. With all screws snugged tight, the compound spreads over the whole surface. Wipe off surplus compound before it begins to cure.

When one piece of plywood is on, lay another piece onto the frame and get the edges of the two sections to butt together snug and true. Then fasten it the same way as the first. Make butt blocks of ½-in. or ¾-in. plywood.

With the bottom plywood on, do the sides. They go on the same way as the bottom.

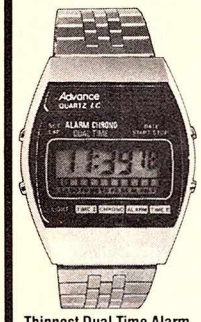
When driving screws into the plywood, turn them up tight so their heads are slightly below the surface. They can be hidden later under a filling of plastic wood or polyester auto-body putty.

At this stage you can remove the hull from the jig. It will twist, but the plywood seats fix that later. Before installing the seats, attach the inner gunwale strips.

The four knees are of three layers of ⅜-in. plywood. This makes knees that are 1⅛-in. thick. The legs of the knees are a little on the slim side so that 2-in. wood screws go through with plenty of thread left to grip the wood to which the knees fasten. If the knees were of solid hardwood, the grain might let them split. Set the knees liberally into adhesive bedding compound and install permanently.

Set the seats about 8 in. below the gunwales. This positions oarsmen so their knees do not foul the oars on return strokes. Make support blocks to go under the center parts of the seats and bed them in adhesive compound at top and bottom. ●

Advance Dual Time Alarm Chronograph



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24 hours, 59 min., 59.9 sec.

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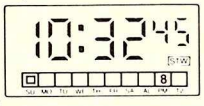

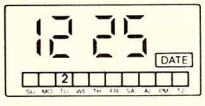

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MI2

Spice Cabinet

(Continued from page 36)

Before cutting the door panel, make a few test cuts on scrap lumber. You can cut the drawer front at the same time since it's a raised panel without a frame.

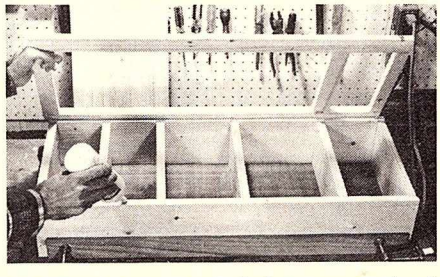
The panel frame is ¾x2-in. pine. We cut a ¼-in.-wide groove 5/16 in. deep down the center of the four side pieces using a router table and a ¼-in. slotting bit. By making several passes across the ends, the radial saw cut matching tongues. Then the panel is edge-glued and bar-clamped together to dry.

The panel door and drawer are framed with 1½-in. pine strips. Rabbet the outside rails ¼x¾ in. for a better glue bond.

While the front frame dries, the cabinet sides can be rabbeted and dadoed. Place the two sides together and rout the ¼x¾-in. dadoes to fit the cabinet shelves, top and bottom. Along the inside back of each side cut a ½x¼-in. rabbet.

Next, cut six shelf pieces, glue them to the sides and bar-clamp to dry. Also glue and clamp the front door frame to the front of the shelves. When the glue dries, cut ¼-in. plywood for the cabinet back; glue and nail in place.

Cabinet drawer sides and the back are made of ½-in. pine. The bottom is ¼-in. plywood.



CABINET sides and shelves were glued, squared and clamped. While they dried, front trim frame was glued to the edges.

Rout blind dadoes for the drawer sides and bottom along the drawer back ¼ in. deep. Then edge-glue the drawer pieces and lightly clamp together to dry.

Be sure to put drawer guides inside the cabinet to compensate for the thickness of the front frame. We glued ¾-in. square pieces for the bottom guides, top tilt guide and side guides.

We topped the cabinet with 2½-in. crown molding and cut ½-in. quarter-round molding for the base. The molding was miter-cut to size, then glued and nailed to the cabinet. Set and cover the nail heads with putty.

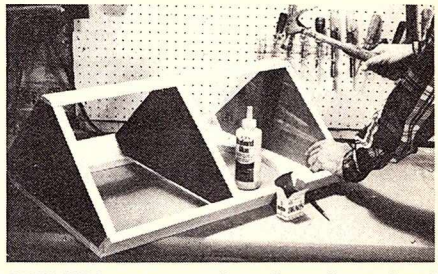
After sanding and staining the cabinet, attach the hinges and drawer pull. We used Cohasset Colonial wood stains to finish all three cabinets. Before staining, we gave each cabinet a prime coat of wood stabilizer for a more uniform base. You'll achieve in minutes that 200-year-old look of prized pine antiques. ●

Corner Cabinet

(Continued from page 37)

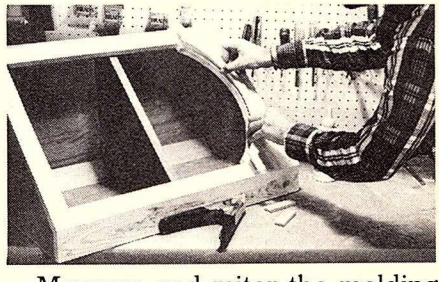
top was cut from ½-in. stock on a band saw and rounded and sanded smooth before gluing. Next, miter the pieces at 30° angles; glue and clamp to dry.

We made the cabinet top molding out of ¾x1½-in. stock using a Roman ogee router bit. Next, we glued a ¼-in. piece of quarter-round molding ⅝ in. from the bottom front edge.



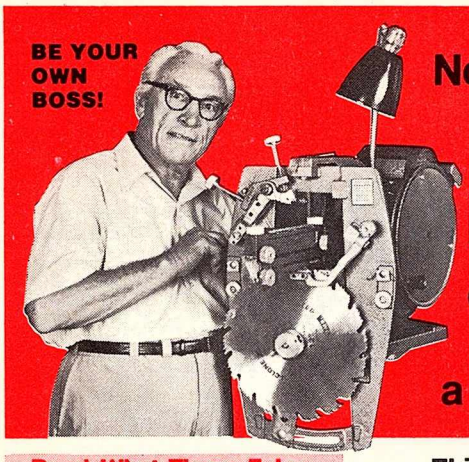
SHELVES were set into face-down front frame, glued and nailed. Then rear post with two beveled edges was glued, nailed.

WALL sides were added after the back post. Curved molding for the face was cut on band saw, then sanded for an exact fit.



Measure and miter the molding at 30° angles and glue to the cabinet top. Since the top piece of molding sits along the top edges of the cabinet, nail it securely in place from the top. You'll prevent nail heads from showing in the molding this way.

Edge the bottom of the cabinet with ½-in. quarter-round molding. And, as before, sand and stain the cabinet before attaching the hardware. ●



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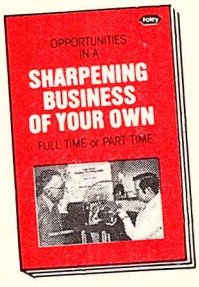

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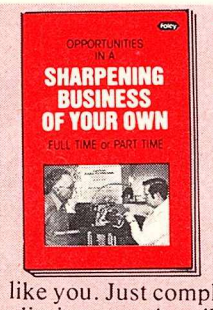

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By Paul Weissler

What to Do When the Rear Defroster Doesn't

YOU BACK your car out of the driveway while the rear window is fogged over and suddenly hear the screeching brakes of a car pulling to a panic stop behind you. That's the convincer. The next car you get is going to have a rear-window defroster.

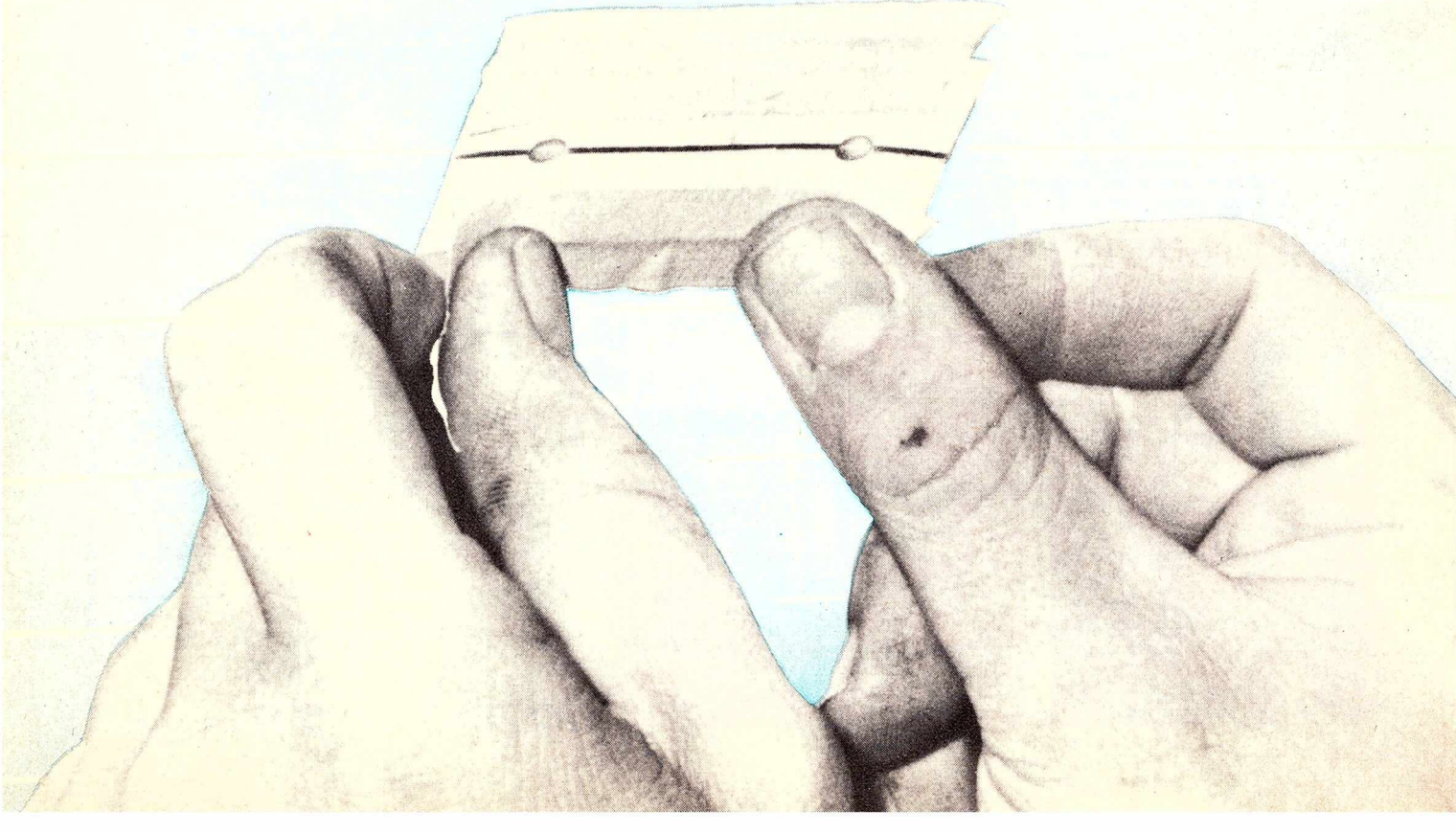
There are two types of rear defrosters: electric grid or blower. The nearly unanimous choice is the grid, horizontal lines of silver-ceramic compound baked on the inside of the glass. It starts working instantly and does the job quickly. Electric grids are so effective, they do more than defog a window. They can actually defrost it, too.

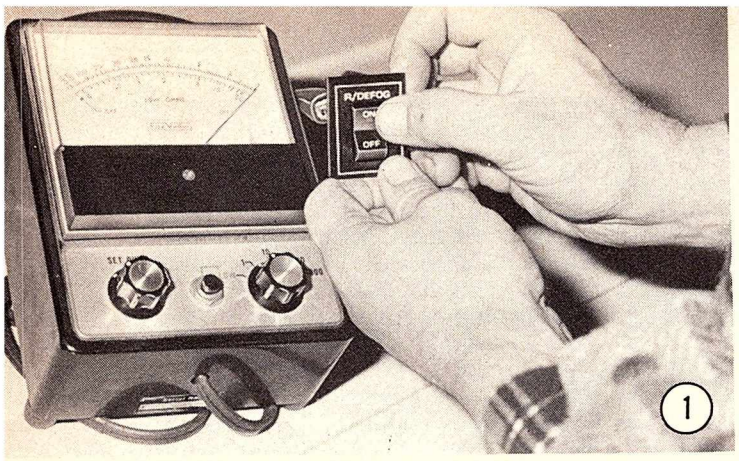
However, baking a conductive grid to glass, making wire connections and hooking up a high-amperage circuit to provide fast action, result in a system that is vulnerable to damage. When you hear about the $50 and up repair charges at the local dealership, you can see why you'd want to handle it yourself. Here's how to check out the system and make the repairs inexpensively.

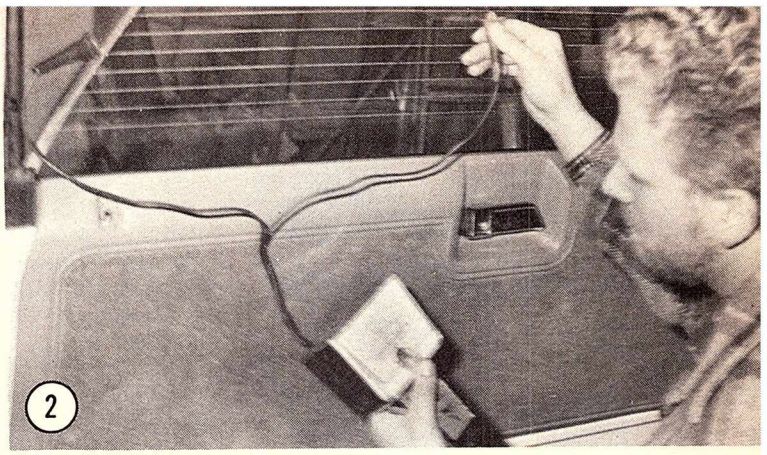
If the defroster clears only part of the window, it's usually a sign of a broken horizontal grid line. If the break is large (¼ inch or so), you can see it easily. But if you can't see it, you can find it with a voltmeter.

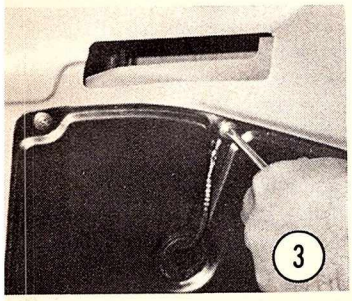
Turn on the defroster. Touch one voltmeter lead to each wide vertical bar, and you should get a reading of 10 to 14 volts. If the voltmeter needle deflects toward a negative reading, reverse the leads and recheck. Once you have a positive reading, you know two things: There is current flowing in the circuit and the vertical bar to which you are touching the negative voltmeter lead is the ground side of the circuit.

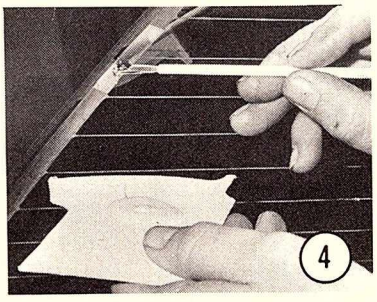
Next, move the voltmeter's positive lead to the midpoint of a fine horizontal grid line. You should get a reading of 5 to 6 volts. If you get no reading, there's a break in the grid line somewhere between midpoint and the positive side of the grid. If you get a reading of 10 to 14 volts, the grid line is broken between midpoint and

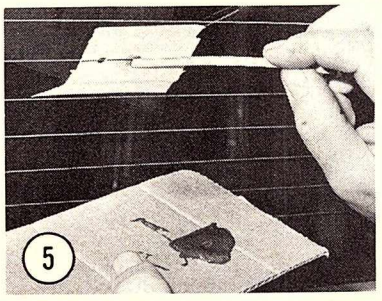


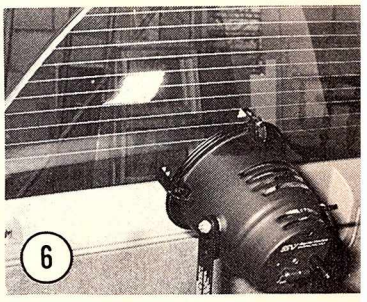












1. **SWITCH is checked with ohmmeter, which shouldn't read the same in On, Off positions.**
2. **USE a voltmeter to find small breaks in grid lines. Move lead until reading jumps.**
3. **TIGHTENING loose ground connection sometimes is all that's needed to repair unit.**
4. **BURGLAR alarm metal tape epoxied over break is quick cure for broken vertical bars.**
5. **TEMPLATE from repair kit keeps you from splattering repair mixture all over the glass.**
6. **REPAIR isn't final until it's heat-cured. Good source of heat is floodlight or spotlight.**

the ground side. Move the positive voltmeter lead toward the indicated break. When you pass over the break, the reading will change sharply.

There are kits for repairing breaks in the fine grid lines. You may find kits in discount houses or auto parts stores in your area for only a few dollars. Or, you could be stuck with paying close to $12, rock-solid list price, as I did at a car dealer.

The kit consists of a template for the repair area and two syringelike tubes. One tube has metallic powder in its goop; the other has material designed to mix with it to form a paste. Clean the area around the break with alcohol and then rub it gently with steel wool. Tape the cardboard template in place, so its slot is aligned with the break. Mix the repair paste, then apply a coat on the template at the slot, so it goes through and fills the break in the grid without splatter on the glass.

Completing the repair requires heat-curing it for about 2 minutes. Without the heat treatment, the patch won't carry a normal amount of current. The minimum acceptable temperature is 300°F (500° to 700° if you want to be sure). Shops that do this work use heat guns, but if you don't have one, don't use a torch—it's dangerous. Don't use a hair dryer, either, it doesn't produce enough heat.

I used a strong incandescent light. Use a baking thermometer to check how close the bulb must be to the repair. Distance varies with surrounding air temperature, to some extent. I tried a 250-watt bulb and found I had to hold it ¼ inch away to get 350°F. A 1,000-watt cured the repair from 8 inches away, providing temperatures of about 400°F. If you're going to run temperatures noticeably higher, peel off the template first so it won't scorch. Allow 24 hours for a complete cure.

When the electric grid doesn't work at all, the problem can't be in the horizontal lines, for it would mean all the fine lines were broken, not likely to occur without your realizing it. However, one of the thick vertical side bars could be broken.

A break there is a bit easier to fix. Clean the bar around the break with steel wool, then cover the break and an overlapping area with foil tape used to wire windows into a burglar alarm system. If you can't beg a small piece from someone with an alarm, you can buy a roll at an electronics supply store. Secure the tape to the vertical bar by painting over with epoxy glue.

If the problem isn't as obvious as a break, begin a checkout by trying to turn on the system. If you hear the system's relay click and the monitoring lamp on the dashboard switch goes on, you know current is flowing. If your dash has an ammeter, the needle should deflect slightly toward discharge side. If it pegs itself on the discharge side, there's a short between the switch and grid. Trace the wiring to find it.

If the relay clicks, the lamp goes on and the ammeter reading is normal, touch each vertical bar with the voltmeter, as for the start of a grid test. If you get a very low voltage reading, or none at all, move the negative lead from the ground side of the grid to another ground somewhere on the body. If the voltage reading goes to normal, the problem is a poor connection from the ground side of the grid.

A poor ground connection can be as simple as a loose screw or corroded connection. On sedans, the connections are accessible after removing the package shelf or trim molding. On wagons, you may have to take off a rear trim panel,

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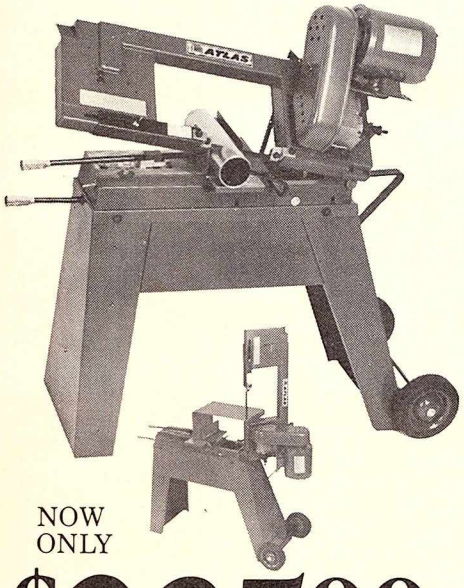

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Rear Defrosters

usually an easy job. Once you have access, tighten a loose connection, or wirebrush a corroded one, then reinstall and tighten. If you find the ground connector has separated from the grid, you may be able to reattach it with 3-percent silver solder.

If you can't get a voltmeter reading across the vertical bars or to a separate ground, it means power isn't getting to the grid. Check the wire connector to the grid. If it has come off, resolder it on or, if that's not feasible, reattach it with a dot of super glue (so a solid metal-to-metal connection remains). Or the wire may be broken somewhere before the grid. You may have to remove trim panels (peel back headliner on some hatchbacks) to check the wire.

If you didn't hear the relay click and the lamp didn't go on when you turned it on and connections at the grid and the switch are good, the problem is in a fuse on models so equipped (most, however, have a circuit breaker in the switch) or in the relay or switch. Many systems have a separate relay at or on the fuse box; others have a switch that combines the functions.

With a combination part, you don't have to wonder what to do. Remove the switch from the dashboard, probe all the connector terminals with a test lamp (to make sure there's juice coming into one of them), then test the switch with an ohmmeter.

On GM switches, connect an ohmmeter across the lower two terminals with the switch lever in the normal position. The reading should be either infinity or a low resistance (perhaps 10 to 15 ohms). Reverse the ohmmeter lead connections; the reading you didn't get the first time you should get now. This is a test for the diode, which should pass current only one way. Next, flip the switch on. The ohmmeter reading should be zero, indicating continuity, with the test leads connected either way. Finally, when you connect the ohmmeter to the upper two terminals, you should get a low resistance reading (generally under 50 ohms) with the switch in any position.

On Chrysler and Ford switches, there should be zero resistance (continuity) between any two terminals (there are at least four) with the switch on and between only two terminals (which vary from car to car) with the switch in the normal position. There should be no continuity with the switch off. If a switch fails the test, change it; if it passes, change the relay.

Some people have defrosters that work normally some of the time, or start all right but don't stay on long.

In the first case, use the voltmeter to look for a low reading. You'll probably find a poor connection at one side of the grid, a bad ground or a broken wire between switch and grid. In the second case, check for a defective timer, that is, one that shuts off the system (and monitoring lamp) in less than 10 minutes. If that isn't the problem, check for poor connections.

If the defroster works but won't shut off, it's either because the timer is defective or the dashboard switch is bad or it isn't supposed to shut off. Not all systems have timers.

To keep grid defroster repairs to a minimum, just remember that it's there; take extra care when cleaning the rear window and don't casually stow things next to it. ●

Add-On Defoggers

The popularity of the original-equipment defroster has led to the marketing of many retrofit kits. Although any weekend mechanic could install one in a few hours, it may not be something you want.

It takes only a moderate amount of current to clear mist from a fogged-up window in mild weather. However, it takes a lot of juice to heat up a window enough to clear frost in very cold weather. When you spend $100 for an original-equipment installation, you get a high-output alternator and a control switch that includes a relay to handle a lot of current. The $8 to $15 add-on kits draw a lot less current.

If you'll be satisfied with defogging rather than both defogging and defrosting, an add-on kit should be acceptable.—*P.W.*

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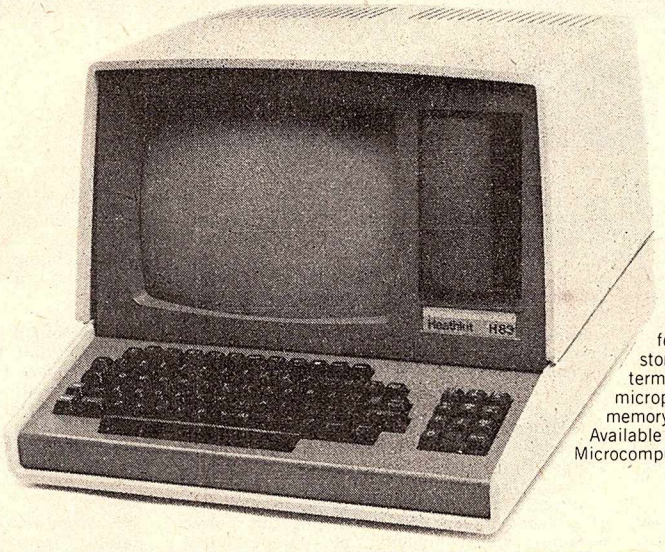

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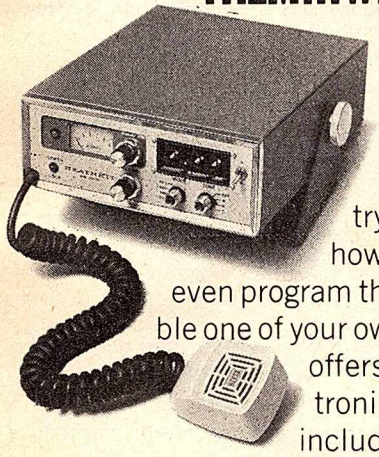

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332. Marine Corps Opportunities. Jet mechanic, computer programmer, electronic instrument repairman. They're just three of nearly 300 skilled jobs in 36 occupational fields for men & women between 17 and 28 to pursue in the U.S. Marine Corps. This full-color 16-page booklet gets into the details. Free.

333. Auto-Body Repair Manual. Designed to assist you in repairing everything from minor car-body scratches to deep dents, rusted-out areas and fiberglass damage, this booklet takes you through the processes step by step. From Duro-Woodhill, the 20-pager also shows the company's line of auto-body repair and car-care products to make the job easier, faster and more economical. 50¢.

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335. Knife Almanac. Newspaper contains information on the making, care and collecting of knives. And it's yours from Schrade Cutlery. Tabloid-size almanac also includes the company's beautiful-beast iron-on for T-shirts, jackets, whatever. Free.

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338. Solar Panel Info. The Solar Collector Panel from Eastern Sun-Tech Industries is said to increase solar-heating efficiency by almost 40 percent over tube-type collectors. This illustrated material discusses the panel and its pluses. 50¢.

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341. Motor-Oil Facts. Quaker State's 36-page booklet, What You Should Know about Motor Oil, discusses your car's engine and how driving affects it, what a motor oil is and does, how to read an oil can and more. It answers many questions on motor oil, whether you use it to power your car, lawnmower, snowmobile or outboard motor. Free.

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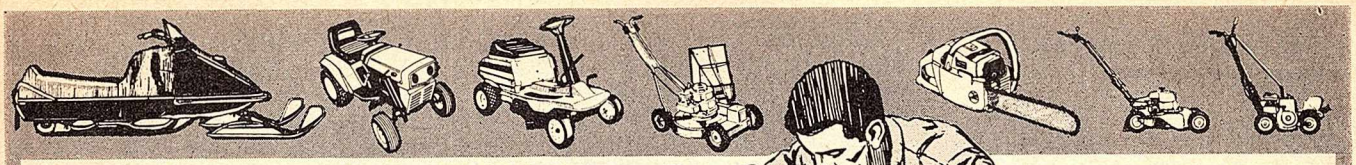

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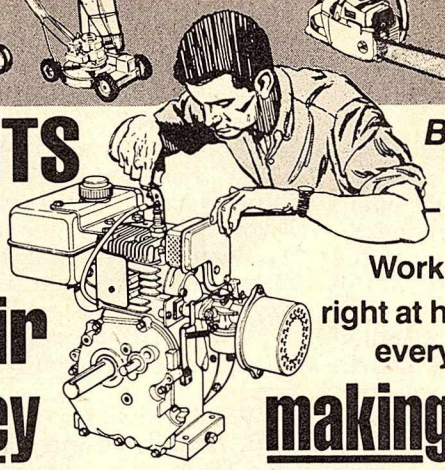

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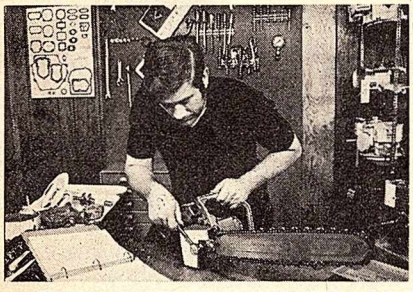

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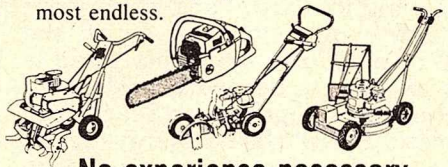

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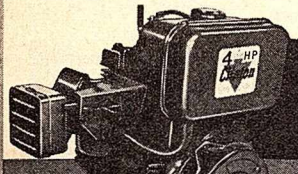

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Zero-Clearance Fireplace

(Continued from page 64)

only as good as the installer who does it . . . by following instructions to the letter.

The Heatilator system does require a few cosmetic restrictions—such as minimum distances of facing edges from the hearth. And a mantel cannot be set too close to the upper limit of the hearth.

When the fireplace is installed on a combustible floor, a hearth extension must be used to protect the floor in front of and on either side of the opening. This is true of any fireplace.

The zero-clearance Heatilator gives you any placement option for installation—back against the wall, in a corner, in a recessed area or at a right angle to the wall.

One system even includes an airtight hearth fed by outside air. Room air is constantly recirculated through the heat exchanger to supplement conventional heating.

—Burt Murphy

Nuts!

(Continued from page 162)

"Son," he said, reaching to scratch his left ear, "I couldn't have been more than a tad when my father sat me down on his knee and told me the one great truth about politicians, and I promise that once you understand that truth, it explains an awful lot of what you can't believe comes out of their mouths.

"My Old Man told me that a politician's first, foremost and only obligation is to get elected, and that once elected, his only obligation becomes to get reelected.

"Now if you understand that," said W.O., beginning to rock back and forth, "you can understand why the politicos have been ducking the energy mess like it was a left hook thrown by Joe Louis in his prime."

"You mean they don't want to risk loosing the campaign contributions handed out by the big oil companies?"

"That's part of it," he said, "but it's not the main thing. The pols are pussyfooting around the energy thing because they know—or think they do—that anything worthwhile, anything that really faces the situation, isn't going to go down too well with voters, most of whom are motorists.

"You see," he said, again leaning forward and pointing a finger in our direction, "politicians—especially the successful ones—deal in votes, and to hell with causes, however noble. That's why every last one of 'em knows deep in his or her bones that there are three things you can't mess around with if you want to get elected to office: You can't mess with a man's wife, his wallet or his car. . . not directly, anyway."

Farmer Brown rocked back in his chair and crossed his overalled legs.

"We may call 'em cars, son," he said, "and drive 'em on roads, and stop for traffic lights and all that, but they're still horses, and we can ride 'em whenever and wherever we want to, and woe unto the man who tells us we can't."

"What you're saying then, W.O., is that the energy mess is of our own doing, right?"

"Yes and no," he replied. "Yes because we're too easily amused—meaning we were so happy with chrome and speedometers that we failed to keep an eye on the sharks—and no because children should not be taken advantage of, even though they beg for it.

"The speed limit nationwide is 55 miles per hour," he said, again leaning forward, "and if we were adult enough to abide by it, the White House wouldn't need a scapegoat to get the President off the hook regarding the energy mess. There'd be no energy mess."

"Better run that one by us again," we said.

"According to some figure wizards," he said slowly, "driving at speeds of 55 and under would burn ten million fewer gallons of gasoline each day. It wouldn't take too many days to get everybody off the hook, the President included. All that has to be done is to get everyone involved, voters especially, to bite the bullet of obeying the law."

"Gosh, W.O.," we said, "if everybody obeyed the law, there'd be no need for scapegoats, and then what would farmers like you do?"

"Heave sighs of relief," he said, standing up to wish us good-bye.

As we walked away from the porch and toward our car, Farmer Brown called after us, "Don't get me wrong. Scapegoats are all right, by 'n' large . . . as long as you don't get downwind of 'em." ●

Making of a Mast

(Continued from page 104)

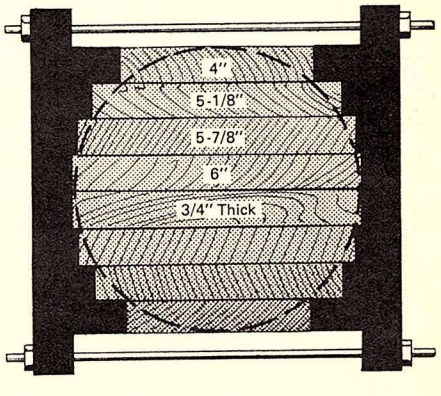
In the spring, we planed the planks to ¾ in. at a local cabinet shop. Then we made a jig for our 10-in. radial arm saw so we could cut a 3¾-in. scarph on the end of each plank. The jig was simply a couple of wedges—on the floor and saw table—that held the planks leaning against the table so that when we pulled the saw blade across the end of the plank it left an angled cut.

The next step was to build a mast bench of scrap lumber. We made 70 clamps using threaded rod with bolts and washers and scrap lumber. And we made side clamps—cut to the profile of the laminates—to keep the different width planks in line. We used Weldwood Plastic Resin glue. Its pot life is reasonable and its price is good.

Glue-up day started early with a 58° air temperature and a 55° surface temperature. We recruited several friends to help, and split them into stacking, gluing and clamping teams.

We used 31 lbs. of powered glue and the entire operation took 1¼ hrs. We mixed the glue in a bucket following the manufacturer's recommendation, and applied it with 4-in. brushes. We covered the laminates with a dark canvas, but tar paper would have been as good. The purpose was to absorb as much of the sun's rays as possible so the glue could cure better.

Two days later we rounded the laminate with an electric hand planer. This created a fairly true surface. Then we used a belt sander to do the final shaping. The total time for shaping was 8 hrs. Then we put on a coat of spar varnish (in case we wanted it natural



DRAWN on paper, 6-in.-diameter circle represents butt of mast. The ¾-in. sections represent laminates. We made side clamps cut to the profile of the laminates.

color in the future) and then painted it buff color.

Finally, we moved the mast to the dock where we had our boat. We laid the new mast next to the old one and began switching hardware from old to new. Today, the mast looks good. Its sail has held up to 75-mph winds. The total cost came to $114.●

A Fish for Winter
(Continued from page 24)

nymphs, as well as an occasional baitfish.

This creates a kind of natural chum line. After 5 minutes of this activity, fish begin to line up for chow at the foot of the riffle.

Whitefish can be caught with a spinning rod or even a fly rod, but my favorite technique embraces the common simplicity of an old cane pole. You rig a line as long as the pole and put a half-ounce bell sinker at the end. A foot above the sinker, tie a snelled hook with a No. 14 whitefish fly on the end. Another snell-and-fly goes 2 feet above that.

A whitefish fly is really nothing more than an attractor—a red or yellow slip of wool or chenille with a simple hackle. The thinking behind the two hooks is to tempt the fish feeding near the surface as well as those feeding off the bottom. It's quite common to catch two fish at once this way.

Anglers use a wide variety of baits in conjunction with their flies; maggots, rice, corn and worms. Some whitefish specialists net their own baits right from the stream using a piece of window screen stretched between two sticks. There's even a science to this, with certain nymph forms favored over others. Whitefish seem to like the cream-to-light-brown stonefly nymphs better than the darker varieties. When I use them, it's impossible to keep a bait on the hook for more than a minute.

The trick to getting whitefish to bite is to keep the bait moving, but very slowly. You work the sinker back and forth across the bottom of the hole in a zig-zag pattern, feeling every contour down there. This sensitivity is important because whitefish are light and quick biters. When they mouth a bait, they give one, perhaps two hesitant tugs. Unless you strike hard and fast, they'll be gone and you'll be on the other end of bare hooks.

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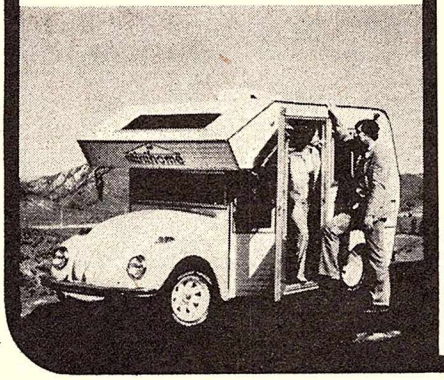

Smart and easily-built, MI's Minihome on a Volkswagen chassis, costs about $1,300 to build. The actual work-time involved comes out to about 120 hours of what amounts to cabinet work.

The complete plans package for building MI's Minihome is available by mail for $15. The package consists of a 14-page booklet detailing construction sets and eight pages of plans sheets showing assembly steps.

To receive your plans package simply print the words **Minihome Plan No. MIRV677** along with your name and address on a piece of paper. Enclose $15 plus $2.00 postage & handling in check or money order. Mail to:
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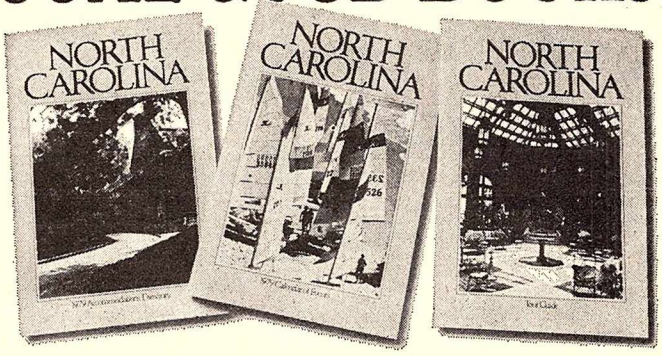

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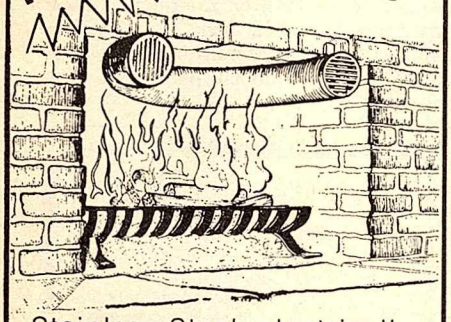

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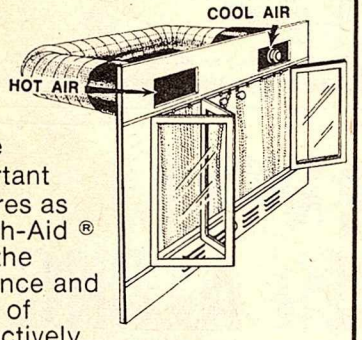

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If you're fast and a little lucky, however, you'll be attached to a 12- to 16-inch whitefish. They are not quite the fighters that trout are, but given the leverage any fish of such proportions can bring to bear on a 16-foot pole, you won't be disappointed in the action. Then, too, when you get a big, hungry school working the riffle, it's not uncommon to take 30 fish in an hour, if you can keep up with the pace of baiting and unhooking. Sport on such a scale tends to take one's mind off the winter.

This same rigging works well on a spinning rod, but there are drawbacks to this brand of angling. A closed-face reel tends to jam up with ice if the temperature is below freezing; an open-face reel cannot be operated with gloves on. Cane poles are foolproof, and you can fish with them in boxing gloves.

Although fly fishermen consider whitefish second best in May, they love them in December. That's because they're almost exclusively insect eaters, and they rise to tiny hatches of snow flies with the pelting frenzy of a heavy shower. When they're not rising, they usually take a green or brown wooly worm, or some feathery imitation of a stonefly nymph. If this idea appeals to you, however, be doubly sure to pick a warm day, as your hands are always wet when you fish with a fly rod. One option that eases a bit of the numbing cold is to wear thin latex dishwashing or surgeon's gloves. They're sensitive enough to touch to allow you to manipulate the line, and they at least keep your skin dry, which contributes significantly to warmth.

Even when whitefish are in the middle of a feeding binge, the cold eventually gets to you. Lord knows that when fish are biting, I'll be there. But after an hour or so in a riffle, the cold begins to eat beyond the barriers of wool, down and Dacron II. At that time, you realize the benefit of a fishing buddy or two, stationed on shore, feeding wood to a crackling fire. There's nothing so welcome and so sweet as a cup of rich, hot chocolate when you step from that cold water.

It takes a while to establish a school of fish below a riffle, and once you quit fishing and grinding away at the bottom, they quit feeding. When you switch stations with a buddy, you keep the fish feeding and yourself warm at the same time. Working this kind of a shift, it's possible to be comfortable for 5 or 6 hours on a stream, more than enough time to fill a gunnysack with your catch.

Realize, too, that whitefish aren't the only critters that may turn up on your hook. Quite often the presence of all that food stirs a trout or two. I once caught a 2½-pound brown on a cane pole while whitefishing, and he just about dragged me off the riffle. Such little victories make winter whitefishing sweeter yet.

What can you do with your catch? Whitefish are delicious cooked any way you'd cook a trout. The only twist in preparation is that whitefish must be scaled. But to my way of thinking, they are best served after 12 hours in brine and 12 hours in a backyard smokehouse. They turn a deep bronze hue and their white flesh flakes from the bone as easily as peel off an onion. One good day on a mid-winter stream provides me with enough smoked fish for a year; heady flavors, rich aromas and a marvelous way to break the routine of winter's discontent.●

Thunderboats

(Continued from page 97)

than in water.

As soon as the boat is in the water the driver climbs into a form-fitting cockpit, starts the engine and moves out. The prop is direct drive—no clutch.

And these babies move out. Muncey says his boat can do 230 mph. For this course, however, it's set up to run about 175 along the straights. He backs off to a mere 140 to 150 to enter a turn—speed depends on traffic, his line through the corner, wind, waves and position in the race—and exits the turn at 115.

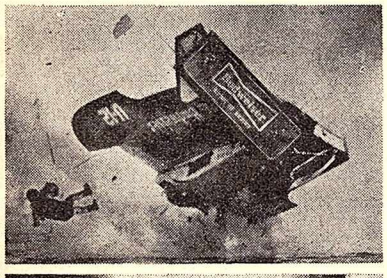
Then, he hits a button on the wheel that injects a short burst of nitrous oxide into the engine. That's right—old-fashioned laughing gas. It's highly explosive and gives a kick in the pistons which causes Muncey's boat to accelerate from 115 to 175 in under 6 seconds. All boats use it, but too long a squirt destroys an engine.

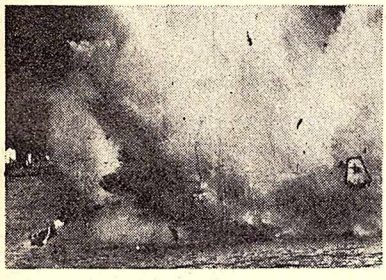
The most popular engine appears to be the Rolls-Royce Merlin, built (under license) in the '40s by Packard. A 1,650-cubic-inch V12, with a two-stage supercharger, it weighs about 1,950 pounds with

gearbox. Most of these engines develop about 2,800 hp and turn max revs in the neighborhood of 4,200. The gearbox increases prop speed about three times over engine revs.

There are a few Allison V12s in use—1,710 cubic inches—but their power output doesn't match that of the Merlin.

We looked at *Miss Budweiser*, another cabover boat always considered a top contender. Owner Bernie Little, a perpetually smiling (he's rich) beer distributor from Lakeland, Fla., invited us to squeeze into the cockpit. It *was* a squeeze. Offset slightly to the left to help balance the boat in the turns is a form-fitting seat designed for driver Dean Chenoweth, a large steering wheel and gauges, including tach, speedometer, manifold, oil and fuel pressure and oil and head temperature.





THUNDERBOATING is a sport with a deadly history. Despite its glamour, unlimited hydroplaning can be a widow maker. Just after our author filed his report from San Diego, the very boat he sat in, Miss Budweiser, disintegrated. Driver Dean Chenowethe, attempting to go over 200 mph, was thrown clear of the boat. Miraculously, he suffered only minor injuries.

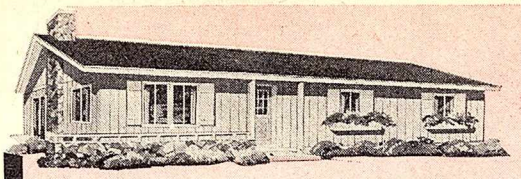
We thought a speedo on a racing boat was unusual, but not so. It's compared against tach and if the tach is high the driver knows something is off. For example, at 3,700 revs the speedo should read 175 mph. If the revs are too high for the speed, the driver knows the prop is bouncing clear of the water and spinning in the air.

Miss Bud has another unusual feature: It's the only thunderboat to use the Griffon engine, a power plant that offers 2,240 cubic inches. It is also 1,000 pounds heavier than it's cousin Merlin, and develops about 3,400 horses.

The San Diego event was run in five five-lap heats, a maximum of six boats to each heat. This is standard procedure for unlimiteds. A somewhat complex point system qualifies boats for the final heat, and the winner there is considered the overall winner.

Nearly everyone who shows up wins some money. For example, to qualify and start pays $1,000, while there is $500 paid for finishing each of the two heats a boat runs. The big money comes in the final heat, but taking home $2,000 for a modest performance can be significant to a short-money racing team.

At San Diego, practicing and qualifying were mostly solo runs. What a Friday and Saturday spectator can see, then, is single-boat exhibitions with plenty of time be-



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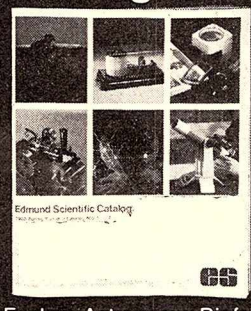

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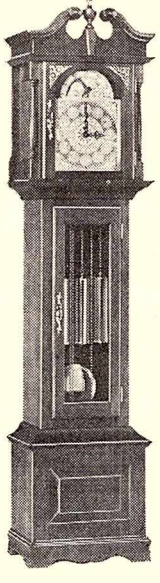

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tween runs. It tends to be, in a word, boring.

Race day was slightly better. A bit of morning qualifying and fine-tuning was followed by the first heat at 12:10; the next was a half-hour later. The next two heats came at 2:10 and 2:40, and the final trophy race was run at 4:10.

Unlimited races, incidentally, tend to start on schedule. Boats are put in the water, fired and make a couple of warm-up passes around the course. The trick is to hit the starting line precisely as the clock counts off the last second. A jumped start costs a full lap penalty. It's the jockeying for position at the start that provides some of the hottest, and closest, high-speed action.

It's not like Indy or a NASCAR Grand National, where the track is crowded and action may last a solid three hours. These boats could not endure that much pounding, nor could the drivers. The pace is relaxed between heats. As a spectator you can picnic and loaf, but when the boom of a half-dozen thunderboats readying for a heat blasts across the water, pay attention. It doesn't last long, but what happens is definitely worth seeing. ●

Paneled Cabinets

(Continued from page 81)

add shims. Put in cover plugs next.

Cut the pieces for the drawer frames and assemble them with one dowel in each corner. Rabbet the back of each frame to clear the drawer veneer and rout the front molding. We used a 3/16-in. radius Roman Ogee cutter and ran the molding deep for the best look.

For each drawer front, cut a piece of veneer and apply it with contact cement. Also, cut file holes for the handle screws, latch knob and file-holder knobs. An easy way to compensate the latch mechanism for the additional panel thickness is to file a notch in the latch arm for the spring wire.

Attach the drawer frame to the drawer with ½-in. No. 6 sheet-metal screws. The top three drawers have a false rail attached to their bottom edge. It's simpler than framing fixed rails between the stiles.

After sanding, we stained the cabinet with Woodkote Fruitwood and gave it three coats of Constantine's Wood-glo varnish. ●

Sporty Marine Diesels

(Continued from page 99)

We drove the 145 DTS in a 25-foot aft-cabin Bayliner on Wisconsin's Lake Oshkosh, near the Mercury factory. This is a fiberglass, deep-V hull of the type for extended offshore cruising. It's a rugged, sturdily built boat, made even heavier by the fact that she was fitted with full living accommodations for two couples.

The engine is a 4-cycle, 4-cylinder in-line design of 3.6-liter displacement (219 cubes). It has a 4.01-inch bore and 4.33-inch stroke, with a compression ratio of 16:1—very low by diesel standards. Its 145 ponies are delivered at 3,000 revs and a governor keeps you from exceeding 3,150 rpm.

This governor makes prop selection a bit tricky. The ordinary way to pick a prop is to keep going down in size until the engine overrevs, then back off one pitch. But on the 145 DTS, the governor prevents overreving. So you go more by feel than the tachometer.

The engine does not use glow plugs for starting . . . another unusual feature. Instead, it uses a preheater that heats the air in the intake manifold before it's injected into the combustion chamber. Fuel and air fire spontaneously on injection due to heat from compression.

The 145 DTS has exceptional cooling capacity, necessary because the engine is turbocharged. Turbocharging builds up heat, which shortens engine life unless you get rid of it.

Beautiful as diesel engines are, they give two big headaches. The first is the possibility of running out of diesel fuel. The second is getting fuel with water in it. Both have been known to make strong men cry.

Running the tank empty on a diesel requires a mechanic to get it running again after you have filled the tank. You can't just grind on the starter to fill the lines as you do with a gasoline engine, because of the high compression.

So, a manual pump-up system has been provided on the 145 DTS. There's a little lever on the bottom of the manifold which you push up and down until the lines are filled. There's also a valve on the opposite side with which you can bleed them.

The second problem—water in the fuel—can cause engine repairs of staggering cost. So, this mill has a factory-installed fuel filter and separator to keep water out of the fuel flow. And it's not just a filter. It's actually a centrifuge which separates both water and dirt out of the fuel. It also has a clear bowl for visual inspection of the deposits.

Net weight of the engine is 1,173 pounds, surprisingly light for a midpower diesel. And it is beautifully small and compact, measuring only 39.3 × 22.1 inches and 28.8 inches wide. In the engine room of the Bayliner there was vast room on both sides. You could sit down alongside of it and still have room to spare.

Firing the engine, in about two pops we were off and running. Performance was not neck-snapping, but it was satisfactory. Running at a high angle of attack to reduce wetted area, we held around 25 mph. The boat handled like a feather, and—throwing her into sharp turns to both port and starboard as you'd do when avoiding kelp—never lugged down or cavitated. Sound level in the cockpit was about the same as with a gas engine. And we found no diesel smell.

Summing up: No diesel engine in boat or car can be justified on a basis of economy. Not one of us runs our rig enough to make diesel pay off.

What diesel does do in a boat is come close to doubling cruising range for the same number of gallons aboard. And add to this that it may be (in the future) that diesel will be easier to get hold of in a crisis than gasoline. Also add to this the far greater safety factor that a diesel has over a gasoline mill. When you look at it that way, a sporty little diesel makes a lot of sense in a boat.

And this new MerCruiser 145 DTS seems to be a good sporty little diesel.●

A Boat for All Seasons

(Continued from page 108)

and Arkansas came up with the idea of making aluminum copies of the Ozark johnboats they saw traversing the local rivers. Because the johnboats had no decks, several could be nested easily in a space-saving stack. A large number could be loaded onto a trailer and shipped to distant markets at low cost. Johnboats from the Ozark region began to show up at tackle

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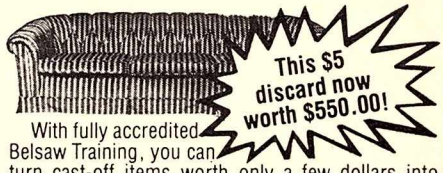

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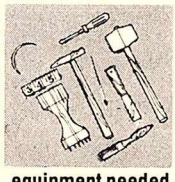

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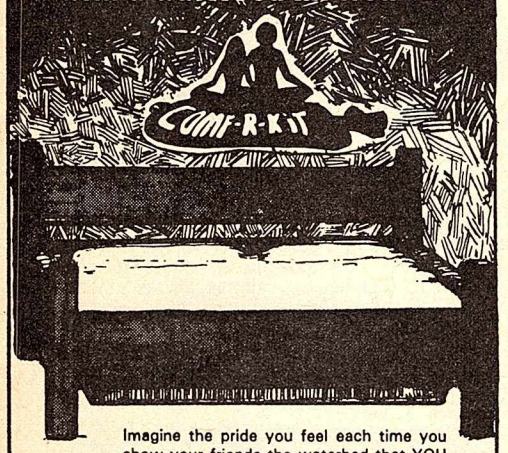

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shops and in discount houses in areas a good distance from the Ozarks. But still, it was natural for people to call them Ozark johnboats.

But what were johnboats like before aluminum came about?

People from Colorado chuckle when they hear mention made of the Ozark Mountains, few of which are over 2,000 feet. But those hills are tall enough to collect a lot of rain, which gathers in their valleys to form small rivers like the White, Gasconade, Big Piney, James and Osage, to name just a few.

Settlers of the 19th Century found they could catch good-eating fish such as bass, catfish and suckers in these streams. By the 1900s, some of them were making a living at commercial fishing. And to cover more territory and get at the hot spots, they began building specialized boats—johnboats.

With johnboats, the paddle was and is used on one side and then the other as course-keeping and arm-fatigue requirements dictate. And all boats designed for paddling are narrow. That way, the paddle is dipped straight down into the water without the boatman leaning from side to side. Some johnboats were only 2 feet wide across the bottom and as much as 30 feet long.

Being both slim and weighty, johnboats would drive easily and coast a long way on momentum. That made them handy for drifting up silently on likely-looking bass holes. Another plus for this narrowness—seldom over 3 feet across the gunwales—was the ability to slip through narrow gaps between river rocks.

Ozark Mountain men began making johnboats before the car, radio and TV had arrived in our culture. Often a man in one village had no idea what was happening in a town just 50 miles away. And he'd never seen a book on boatbuilding. So, early johnboats came in many different shapes and varied in detail. A fellow who could make a feed trough for livestock could cobble up a larger one that would float on the river, even if it handled poorly. From there, it would be easy to make scowlike ends to reduce drag while paddling.

During the first two decades of this century, people in the growing commercial and industrial cities of the midwest began to discover the Ozarks as a vacation land. By 1930, float-fishing trips down Ozark streams had become a thriving business. Johnboats shrank to 20 feet and less in length, for now they had to carry only a guide and a client or two. After several days of drifting downriver, the boats would put in at a town and be trucked back to the starting point.

The postwar years brought many changes. Johnboats going aluminum was but one. Artificial lakes were being built by damming up rivers. This called for shorter, wider, higher-sided johnboats intended to be driven by outboards rather than to drift along with the current.

The johnboat's flat bottom offers shallow draft. Adding an outboard motor with the shallow-draft drive feature lets one of these rigs sneak up creeks and across sand bars where other craft get hung up. When a johnboat slides up on a beach, the flat bottom steadies it while its overhanging bow reaches up over dry ground. It's an easy craft to step into and out of from shore.

Early aluminum johnboats were narrow and low-sided, and this style is still available. They were originally offered with the idea that they'd be used in place of the wooden ones for slow trips on sheltered rivers. They slip easily between the wheel wells of a pickup truck.

But recently, johnboat manufacturers have begun offering new models that are wider and deeper. We now have two distinct classes of johnboats. The narrow, low-sided ones tend to be between 32 and 36 inches wide across the bottom and from 10 to 12 inches high in the sides. They're fine for car-topping or toting in the beds of pickup trucks. They do well—and safely—on the smaller outboards up to 10 hp.

The smaller, lighter johnboats sell for prices in the low hundreds, the larger and heavier ones in the mid to upper hundreds. Nowadays, makers offer more sophisticated johnboats with shallow-V bottoms for better control and which ride with 35- to 60-hp motors, swivel-type fishing seats and carpeted interiors.

The johnboat isn't designed for rough-water use. If you use one on a lake or bay, you'll get a pounding when going into wind-driven waves. It isn't too bad when your boat is going at the moderate speeds generated by motors up to around 10 horses, but favor a pointed-bow boat if you encounter waves frequently. ●

The Cone Brake

(Continued from page 93)

of the wheel. A specially designed rim is bolted to the cone to make up the wheel, much like the wheels on heavy trucks.

The small three-sided brake shoe assembly has pad material bonded to it on two sides. The shoe is forced into the cone of the rotor by a hydraulically activated piston housed in the backing plate. This creates a wedging action that actually covers more swept area than either drum or disc types.

During our time behind the wheel of a VW Rabbit equipped with cone brakes we found much less fade than in a car with stock brakes. This is due to the open design of the rotor which allows faster cooling of both the pads and rotor.

We also noted quicker stops. With the larger swept coverage of the pad-to-rotor surface, friction has been increased, making for surer stops. Less pressure is needed since the cone design is more touch-sensitive. There are several other notable advantages. The cone brake is extremely quiet, not having the squeak of discs or the groan of drums. Being open in back, the cone brake is also self cleaning for longer life.

When the cone system is used both front and rear, as in the case of the Rabbit, there's an elimination of 88 parts over the standard disc/drum combination. Fewer parts means less weight in this case. In stock form, the VW total brake assembly weighs 102 pounds, including the wheel center sections. The cone brake version totals 57 pounds. That's a reduction of 45 pounds (44 percent).

Fewer parts also means less raw material, lower costs and easier service. Each of the front brake shoes can be removed simply by taking out the single screw that holds the abutment block to the backing plate. The shoe then slides down and out, ready to be replaced. The wheel doesn't have to come off. To service the rear, the tire, rim and spider can be taken off as one piece from the spindle.

The parking brake would operate off the standard linkage from either a hand or foot lever.

Don't expect to be able to get a set of these cone brakes on your new car; the Rabbit we drove was a prototype. Further research into correct pad materials and other variations of the diameter of the cone as well as the angle of the pads needs to be done. But the fellows at U.S. Steel think they should have all the problems licked by the mid-'80s.—*Bob Tripolsky*

Mating Stove & Fireplace

(Continued from page 72)

opening. Fasten it in place with sheet-metal screws and seal the whole thing with furnace cement. Irregular openings could be partially stuffed with mineral wool. What you're trying to create is an airtight seal over the flue opening—one that can be easily disassembled for cleaning, of course.

To finish the job, attach the stovepipe to the flange on the bypass and mate the other end to the stove. That's when the hefty neighbors come into play. Fasten the pipe with screws, cement it and go have a beer.

Meanwhile, consider the installation. To be safe, there has to be a minimum of 36 inches between the stove and any combustible surface. You may need to install a heat shield on any wall that is within 36 inches of the spot you place the stove. The stove must be on a noncombustible surface extending 18 inches on all sides, with room underneath for air to circulate.

Above all, check local building codes to see if you need a permit to install a stove. And notify your insurance man of your intentions. You may want to request a written inspection report.

A wood stove can be a thing of joy if installed with proper clearances, operated sensibly and kept in top-notch condition—that means clean, free of creosote.

Heating with wood is a pleasure gaining renewed popularity in this country—it hadn't lost that much ground overseas—and, if nothing else, is a proven boon to the energy-conscious.

Car Care Clinics

(Continued from page 54)

many scheduled by that outfit, the audience was shown how to do an engine tune-up, how to change the oil and air filters, even how to repair a rusted-out hole in a fender. (It was actually a man-made hole. Who could wait for a fender to rust?)

An engine on a stand (supplied by Champion, the spark-plug people) was used to demonstrate how a conventional points-type ignition system (as opposed to an electronic ignition system) works. The demonstrator showed how to remove the distributor cap and inspect it for cracks, burns and wear. He also demonstrated a simple way to avoid the beginner's mistake of mixing up the plug wires if they

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have to be disconnected. Clamp-type clothespins with the cylinders' numbers inked on them clipped to the proper wire.

We helped him show how to inspect the roto and remove the points and condenser. We also had an opportunity to adjust the points using a feeler gauge and again with a dwell meter. It's all simple stuff and the demonstrators did a good job of making it seem so for the novices in the audience.

These clinics don't teach the first-timer how to do a complete stem-to-stern overhaul on his best friend's car engine (his worst enemy's, maybe), but what it does is show him he *can* do the basic stuff.

At the Toronto clinic, it was time to do some exterior work, to patch a fist-size hole in a fender. *That's work for a body shop,* onlookers might have thought. However, using a sheet-metal-repair kit we did a creditable job of turning a jagged-edge hole into a smooth surface ready (after a little sanding) for painting.

This clinic being the first conducted by Woolco, naturally there were some problems. The microphone system betrayed demonstrators occasionally. Needed tools often weren't there. The biggest fault, we thought, was that the demonstrations were performed on a stage on horizontal surfaces. Result: The audience often couldn't see what was being done.

These problems could be remedied with better planning. An easel-type arrangement would let everyone see what's happening—the whole point of the clinic.

Since the clinic we attended was held in the afternoon, when nine-to-fivers couldn't attend, the audience was mostly made up of housewives, teenagers and retired types. Still, by some of the questions asked, many folks seemed genuinely interested in learning how to work on their own cars.

In addition to demonstrations, booths were manned by four well-known Canadian car care outfits—Holt Lloyd Canada Ltd., Wells Ltd. and Champion Canada Limited. Company personnel offered one-to-one instruction and advice.

The Woolco Car Care Clinic may have done for some folks what it and others like it are designed to do—get them involved in do-it-yourself car care. Then, when they pull into a gas station, they can say, "Just fill 'er up. I'll check the front myself." ●

Build UrbaSport

(Continued from page 32)

when the engine is idling and automatically engages when you step on the throttle. It upshifts as speed increases.

Acceleration isn't quite as brisk as the early 36-hp Volkswagens, but it's smooth and steady. That's due primarily to the rig's power-to-weight ratio. The early VWs had about 44 pounds for each horsepower. Our 900-pound three-wheeler has about 56 pounds per horse. The exhaust note is like that of a well-muffled motorcycle.

Best mileage is obtained by accelerating to speed, then backing off on the throttle to get engine speed down. The torque-sensitive transmission automatically upshifts with reduced throttle settings. Cruising at 35 mph should deliver over 50 mpg. Running flat out at 60 mph brings mileage down to just below 40 mpg. You see, even with a lightweight rig it pays to keep your foot out of the firewall.

Pushed around corners, the car gives the feeling of being glued to the ground. It simply goes where it's pointed. Pushed hard, all three wheels begin to scrub sideways at about the same time. However, the car remains under control even in the most severe turns.

Good handling is the result of weight distribution and the large tire contact area. About 70 percent of UrbaSport's 900 pounds is carried by the two rear wheels, where it should be in a three-wheel configuration. The low center of gravity and rear antisway bar give cornering capability unmatched by all but the most exotic production cars.

Braking is normal, with weight-carrying rear wheels set to lock up before the front. Matter of fact, about the only unusual characteristic in driving this three-wheeler is that looking over the nose gives you the impression that the car is narrower than it is.

Our gasoline version is powered by the Briggs & Stratton 16-hp, 2-cyl. industrial engine (retail price: $585). However, just about any engine of this horsepower rating may be used; even a single-cylinder mill will work.

The gas version of the car carries a 17-gallon fuel tank down the center of the frame under the console.

In the electric version, batteries are carried down the center in place of the fuel tank. The chassis is designed to carry up to ten batteries—five down the center and five positioned around the motor in the rear. However, as few as eight batteries may be used. Batteries are the deep-cycle type used in golf carts and have to be replaced every 15,000 to 20,000 miles.

Figuring battery replacement at 2½ cents per mile and the cost of electricity at 1 cent per mile, the total operating cost comes to 3½ cents per mile for the electric. On the surface, it looks as though the gas version has a slight edge in operating costs. With gas at a buck a gallon it's roughly 2 cents per mile for fuel. However, the electric motor should be good for nearly 100,000 miles with little or no service—no oil changes, no air cleaners, no tune-ups.

A major overhaul on an electric motor consists of replacing brushes and turning the armature. Overhauls on a gas engine are more involved, with rings, valves and rod and crank bearings requiring replacement.

So choosing an engine for your car really boils down to what your driving needs and wants are. The gasoline rig gives you range whereas the electric provides quiet, pollution-free transportation . . . and no gas lines to deal with.

But whether you build the gas or the electric version, this latest in the Urba line is easier to build than anything we've offered in the past. Both earlier Urba designs required you to construct such things as drive axles, suspension systems and even the final drive housing. For this rig, we've relied on available assemblies that can be purchased from a wrecking yard and thus save building time.

The body is built first of 1-inch-thick sheets of rigid urethane foam. The material is inexpensive and easy to work with. About $60 worth of foam and a couple of weekends are required. The foam panels are cut to shape, then glued together on the chassis.

The next step is to cover the foam body with fiberglass. This process eliminates the need for a mold and the resulting body shell is lighter and stronger than a standard single-skin fiberglass body. The fiberglassing takes another couple of weekends. The remaining time is spent finishing the body.

The result is a comfortable and highly personalized car that provides transportation at a cost on par with that of a motorcycle. ●

Richard Petty says,

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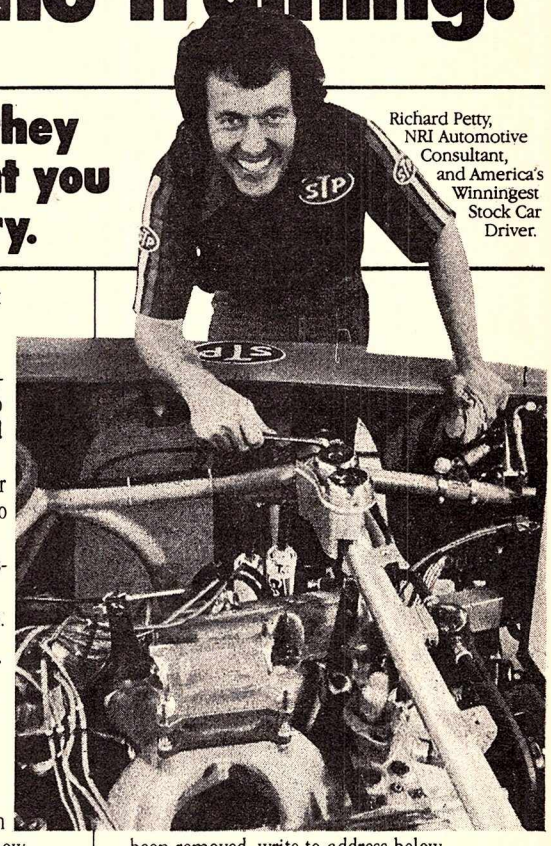

Richard Petty, NRI Automotive Consultant, and America's Winningest Stock Car Driver.

My Dad made auto mechanics out of us long before he'd let us enter a race...so early on I learned the importance of being a good mechanic...and why good training is important. That's why I'm sure glad to see these two NRI courses come along. With NRI, you learn at home in your spare time, at your own pace. And you get solid, "hands-on" training for practical experience. It's a lot of training for the money.

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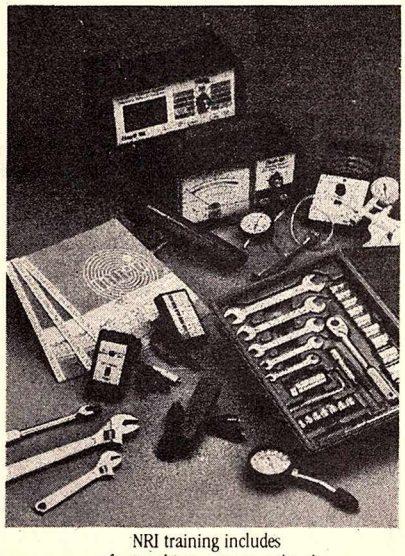

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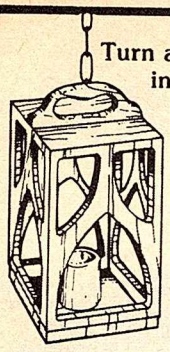

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Honda Civic

(Continued from page 39)

the miserly mileage, gives pretty good cruising range.

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So you can have fun driving and not feel bad about doing it. You can feel bad *while* doing it though.

Interior volume of this Civic is up 13 percent from last year's. But there's no gain in headroom and only about an inch or so more front legroom. The extra space goes primarily to width for more shoulder room. My 6-foot 1-inch self wasn't comfortable. Both my arms and legs needed to stretch just a bit more.

The seat bottoms were comfortable, but the adjustable backs not only didn't have a detent where I wanted it, they didn't match the curvature of my back and were firm in the wrong spot.

The rest of the interior of this top-line GL was fine. The main pod of the dash has a large and easy-to-read tach and speedometer with tripmeter, visible through the comfortable four-spoke steering wheel. Warning lights go across the top of the instrument pod. The left-side directional stalk controls the headlights; the right-side stalk controls the wiper/washer. However, the switches for the rear wiper/washer and rear defroster for some reason protrude from the side of the instrument pod. The heater controls are easy to work and are in the main center of the dash. The three-position fan gets noisier as its speed gets higher, noisy enough to make you shut it off.

The storage space in the rear isn't anything you'd consider putting a set of drums in. The spare tire, jack and tools are under the rear carpet. With the rear seat folded down, there's a respectable amount of cargo space. Rear-seat room is such that you'll hardly use the seat anyway, so you can leave the seat down.

Being fun for the average guy means that the car has to be affordable. The top-model GL 1500, with its luxury interior, radial tires, digital clock and rear-window washer/wiper, sets you back $4,949. Not bad for the luxo version.

You can opt for the base 1500 for $4,059. It should give the same enjoyable performance as its rich brother. At the bottom of the list is the base 1300, which offers the same handling (and the bonus of not needing unleaded) but less power for $3,695. Between top and bottom is a DX version.

Now, I figure that a car for that price, that's a ball to drive while delivering the kind of economy that this one does, is an awfully good bet all around. ●

Ocean Power Hits Hawaii

(Continued from page 41)

feeble 10 kilowatts. Instead, the power is used to further the necessary research that would, it is hoped, enable the giants of OTEC's future to get off the drawing boards and into the water.

OTEC, of course, is really a solar system which uses the surface of the ocean as the world's largest solar collector. OTEC plants would occupy the least expensive and most abundant real estate on the globe and they would seldom be seen except by merchant seamen and an occasional yachtsman.

The OTEC system does not pollute. It does, however, bring the deep, cold waters to the surface. But these are warmed only 2 or 3 degrees before being discharged to return to the deep regions, where they find their own temperature level again.

There is another intriguing possibility about this cold water: In all the areas of the world where cold, deep water is brought to the surface there has generally been abundant fishing (for example, the Grand Banks off Newfoundland or shallows in the vicinity of the Chilean coast). It's possible that OTEC plants could have the same effect and it may be desirable to keep that nutrient-rich water on the surface.

Is there a snag somewhere to all this? Nothing major, say the experts. A cost analysis by Department of Energy officials shows that OTEC power can be competitive with fossil fuels or nuclear systems. Mini-OTEC has proven the system does work today. Proponents claim there's no better legacy to leave future generations than an energy system that is clean, nonpolluting, doesn't chew up real estate and maintains a balance between the amount of energy received from the sun and the amount we use. ●

A Handle on Heat
(Continued from page 14)

ture that works like gangbusters. It consists of a device that must be cocked before the wick can be ignited. One is an iris diaphragm.

Once cocked and ignited, the undisturbed heater does its thing. But if it's tipped, banged harshly or carried carelessly, the diaphragm snaps shut and the flame goes out. I tried the safety on all three a couple of times each and it worked with a snap every time.

Filling the tanks is effortless, with nary a drop spilled. Kero-Sun gives you a squeeze-ball syphon that transfuses the heater from a reserve tank.

Another feature eliminates the need for a match to light the wick. Simply press a button and a battery-powered igniter glows just above the heater's wick. The flame slowly works its way around the circular wick and in about a minute the heater is in business.

The three take from about 15 to 30 minutes to make their presence felt. The 18,000-BTU Omni 105 is a real cooker (even at half-wick) and can easily handle a big living room (with the doors shut) or a large, unheated workshop.

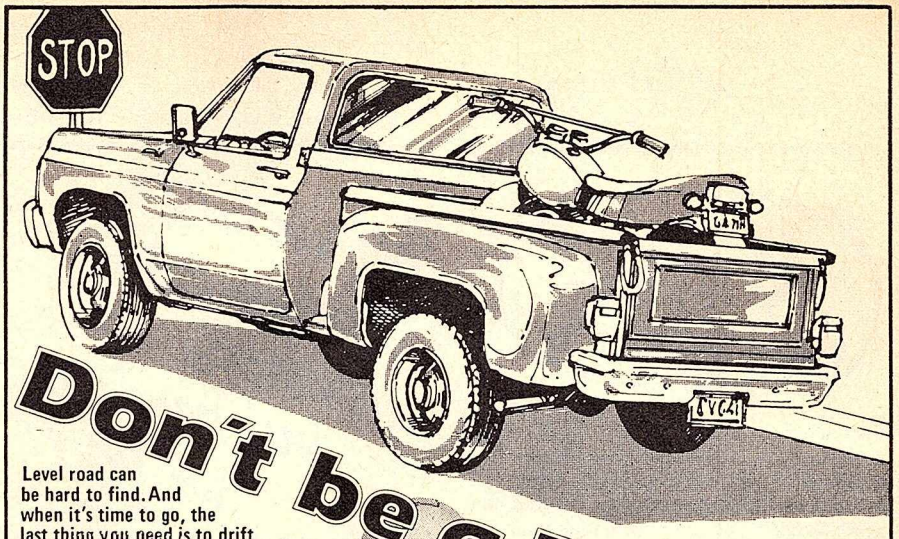
The Radiant 10, at 9,400 BTUs, has a concave, multifaceted stainless-steel mirror that reflects heat sideways and a register on top that drifts heat upward. It's an excellent heater for a medium-size room—after the furnace has been lowered late at night.

The 9,000-BTU model is called The Moonlighter and is a perfect sidekick for hauling around with you. Given enough time (about 30 minutes), it heats an average-size room for sweater comfort. I also use it outdoors, as a hand-warmer.

All three heaters are odorless, as advertised, providing the wick is cleaned of its charred edge every two or three uses. If the wicks aren't kept clean, kerosene odor is present.

So, too, are all three smokeless, except for the first minute of ignition. The smoke dissipates along with the initial odor.

The heaters aren't cheap, but there is a lot of engineering performance and safety built into them. The Omni 105 is $239.95, the Radiant 10 is $199.95 and the little Moonlighter $159.95. Four other models range from $140 to $210. Kero-Sun is located on Main St. (no number) in Kent, Conn. 06757. ●



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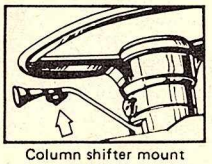

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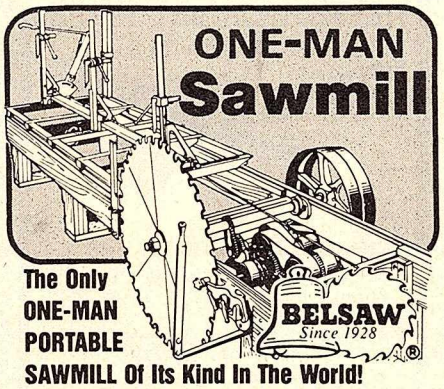

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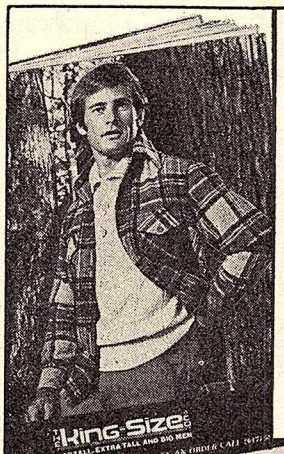

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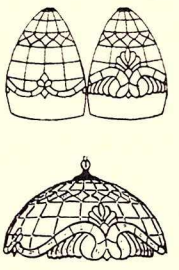

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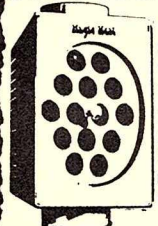

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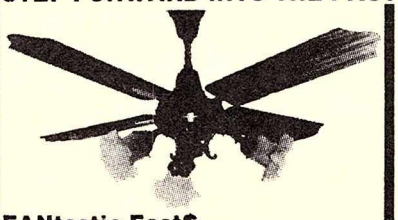

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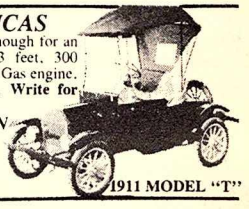

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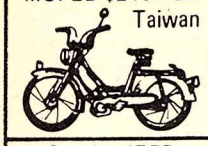

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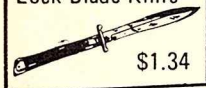

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DISCOVER PROFITS OF IMPORT! My Home Mail Order Import Business Plan guides your every step . . . it is based totally on my personal success. Shows how to deal direct and cut out costly middlemen. . .so you keep all the profits! I do the "hard work" for you . . . by traveling the world to find dazzling "first time offered" new imports. The actual sample I will send you Free is typical of my import discoveries. You can pick and choose from more than 24,000 products. Deal in one product or 1000's. Buy below wholesale.

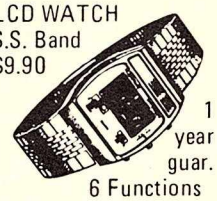
YOU CAN START IMMEDIATELY. I arrange free membership in exclusive International Traders organization . . . instantly puts you in direct contact with suppliers abroad. I show how to operate anywhere. Age no barrier. Ideal for spare time husband/wife or retirement business. My report, "How to Import and Export" tells how to do it. No obligation. No salesman will call. Certificate brings your free gift sample import and everything else.

Leather Soccer Ball $4.25

YOU CAN BUY ONE AT A TIME OR BUY IN QUANTITY

Many of these **24,221** imports you can buy one at a time . . . others you can order in quantity, with minimum total order as low as one Jade Ring **2.75** ppd. or **1.28** in quantity. Other examples, one Mink Coat **299.** ppd. One LCD Watch **14.** ppd. or **10.80** for 25 or **9.90** for 50, all postpaid. New government ruling makes thousands of imports free of any duty whatsoever, making even larger profits for importers. Cut out greedy U.S. specialty merchandise middlemen. Really deal direct, the International Traders way.

LCD WATCH S.S. Band $9.90

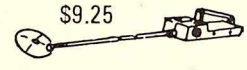


1 year guar. 6 Functions

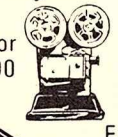
Mink Coat

$299

Metal Detector $9.25



Movie Projector $2.90



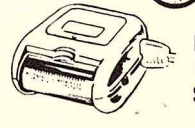
96c Electric Toothbrush

Field Glasses $3.55

Jade Ring $1.28

Cassette Recorder $12.80

Kids Tricycle $5.99



Electric Razor $3.70

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Now! Quick Double Profits

As a Member of International Traders you also get free catalogs of specialty merchandise to order at rock-bottom prices from big U.S. warehouse.

PERSONAL GUIDANCE!

I believe in giving you my personal help! Regularly I meet I.T. Members at regional closed door Seminars across the country. You will be invited to these meetings.

1000's more dazzling products you can buy DIRECT!

Walkie Talkie	Cigarette Lighter
Golf Balls	Beer Steins
Baseball Glove	Rifle Scope
Telescope	Phone Amplifier
Electric Calculator	Movie Camera
Sapphire Ring	Fishing Rod
Spinning Reel	Swords
Radio	Black Forest Clock

715

This Certificate Good for

ONE SAMPLE IMPORT - FREE

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6100 Variel Ave., **Dept. A2262**
Woodland Hills, CA 91367

Send FREE REPORT, "How to Import and Export" . . . also actual Free sample import. Everything you send me is mine to keep without obligation. Show me how I can start a profitable home business of my own.

Name _____ Age _____

Address _____

City _____

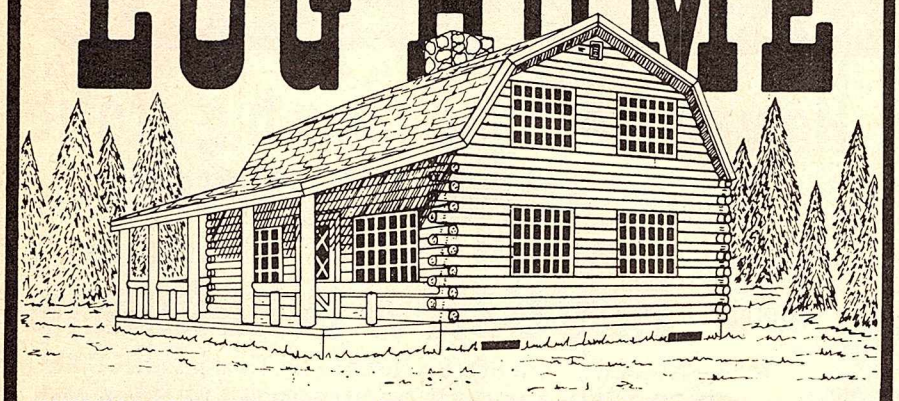
State _____ Zip _____

IMPORTANT

Your initials must appear below to qualify for Free sample import. Because of high cost and limited supply, I hereby agree to limit my request to one, and one ONLY, Free sample Import. I have not previously requested this Free sample. I am over 18 years of age.

Initial here _____

Select Your LOG HOME



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Wilderness Log Homes

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Please Send: ☐ Plan Book $4.00 ☐ Dealership Information Pack w/Plan Book $6.00

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Street _____

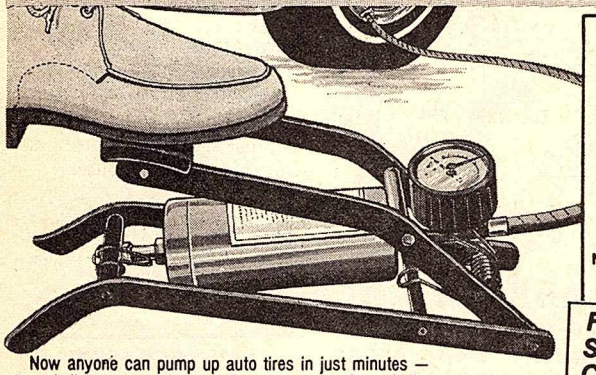
City _____ State _____

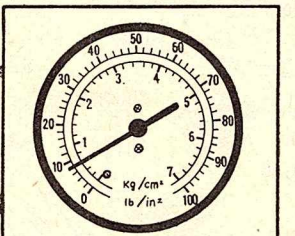
Zip _____ Phone ( ) _____

Remarkable portable pump

Blow Up Anything Fast & Easy!

Gives 100 lbs. of air Pressure INSTANTLY!





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FOR TOYS, SPORTING GOODS, CARS & BIKE TIRES!

Now anyone can pump up auto tires in just minutes — toys, balls, sports equipment, air mattresses, rafts and bike tires pump up in seconds!

This rugged, compact air pump is light weight, completely portable, works with a tip-toe action that's so easy to do. Yet this amazingly powerful pump gives up to **100 pounds** of pressure **instantly!**

Comes complete with a flexible, 24" high-pressure hose and air-tight quick-lock clamp that connects to any tire or air shock made. Also comes with **free** funnel valve for inflatable toys.

Nowadays, with air so hard to find in service stations, you'll want to order **two** — one for home, one to keep in the trunk of your car for emergencies! Just $14.99 each, or order two for $28.99 and save.

90-DAY MONEY-BACK GUARANTEE. You must be delighted with the ease and convenience of our powerful Portable Air Pump, or return within 90 days for refund of purchase price (except shipping & handling).

PHONE YOUR ORDER TOLL-FREE:
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Please RUSH me _____ Portable Air Pump(s) #72613 at purchase price of $14.99 plus $2.00 shipping and handling each.

☐ SAVE! Send TWO for just $28.99 plus $3.00 shipping and handling.

Enclosed is my ☐ check or ☐ money order for $ _____
Sorry, no C.O.D.'s (Ca. res. please add sales tax.)

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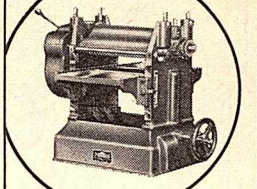

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FREE CATALOG

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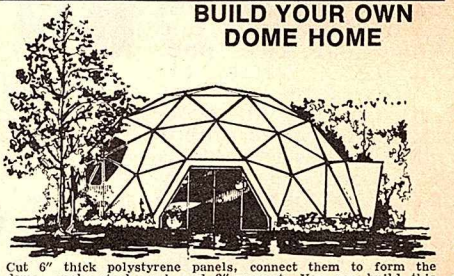

Cut 6" thick polystyrene panels, connect them to form the dome, apply steel mesh and 2" cement. You can build this beautiful, practically indestructible dome, 33' diameter, 17' high for appr. $1900.
Use the spacious, richly insulated, super energy saving dome for cottage or permanent home.
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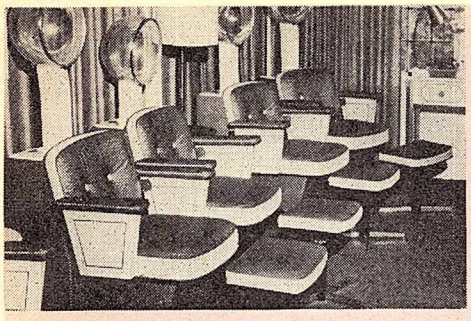

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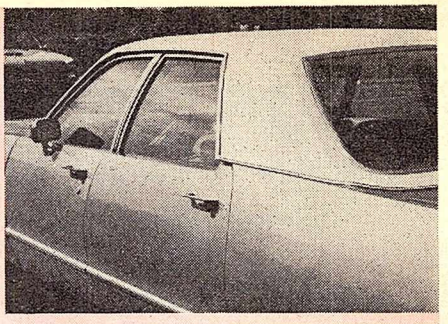

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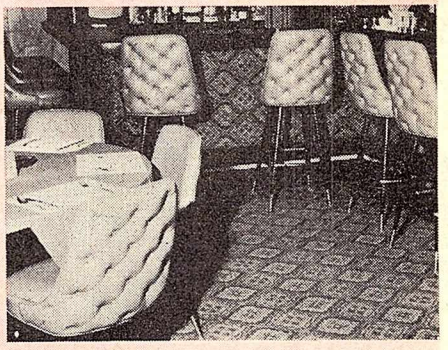
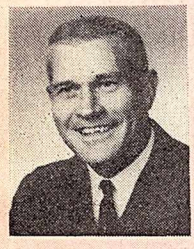


V-115



1st CUSTOMER 3 DAYS AFTER RECEIVING KIT

"Am now doing repairs for 15 auto dealers, 3 furniture stores, 15 restaurants/bars, also bowling alleys and insurance companies. Am averaging $1,000 a mo. already and plan to expand to other towns. As an auto salesman, I know how much vinyl repairs are needed, and 50% of my jobs are on car tops and seats."

C. Gambill, Ohio

ALL THE WORK HE CAN HANDLE!

"I have a few used car lots that use my service, and Montgomery Ward, which really keeps me busy. I also have a Howard Johnson Restaurant and motel. It's all I can take care of."

Ralph Reiter, Fla.

SWAMPED WITH BUSINESS!

"This business is BIG. I did a large bar in a local restaurant. Am doing a job on one of the Bradford House restaurants at W. T. Grant, and they're referring me to other Grant managers. I'm swamped with business."

John Reed, N.Y.

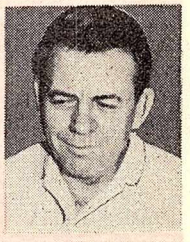
MADE $440 IN 9 HOURS

"I repaired 55 chairs at the NCO Club at $8 each—$440 for 9 hours work. Materials and transportation cost only $35! On another job, made $140 in 3 hours. I'm doing much better than VIP ads say you can!"

David Gagnon, S.C.

BIG, STEADY BUSINESS!

"After only 3 months, I'm doing repairs for 4 car dealers, 3 furniture stores, 6 restaurant/bars, 2 hospitals. Biggest week was $954 for 1 restaurant, 3 car dealers, 1 mobile home. Now go to bank to put money in, not take it out!" **L. C. Rust, Okla.**



START YOUR OWN PART-TIME/FULL-TIME BUSINESS

for less than you'll make in an hour's work

VIP's exclusive Vinyl Repair process puts you in a profitable business of your own, faster and with less money, than you ever dreamed possible. After just a few hours' practice, you can repair holes, cuts or burns in any item made of vinyl . . . car tops, seats, furniture, booths . . . all the things that are made of vinyl these days.

BIG DEMAND FOR REPAIRS

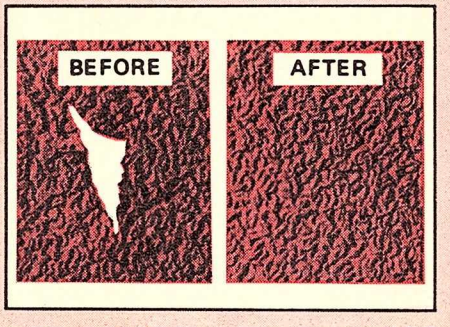
No matter where you live . . . small town or big city . . . every place that uses vinyl needs your service . . . homes, businesses, car shops, offices, motels, hospitals, bars, restaurants, buses, beauty shops, and more.

VIP ON-THE-SPOT REPAIRS PAY BIG

Walk into any place, business or home, and in half an hour to an hour you can repair vinyl damages quickly, conveniently, right on the spot. That small repair can make you $10 to $20, gladly paid by your customer who can use furnishings right away. He saves money – you make it! And most of what you make is PURE PROFIT!

GROUND-FLOOR OPPORTUNITY FOR BIG, BOOMING BUSINESS

This is so new that people are amazed that such repairs are possible. That's what VIP Craftsmen tell us. Craftswomen, too, because it's as easy for women as it is for men. This may be the first time in your life you've had a true ground floor opportunity! One you can cash in on fast and build to as big a business as you want! It's clean, quick, easy and PROFITABLE!



COMPLETE KIT SENT AT ONCE

Your VIP kit is sent immediately for just your small down payment . . . complete with equipment, materials, simple instructions, practice material and everything you need to go into business! Even your business-building guides. You're in business, ready to work for pay, just hours later!

SAY GOODBYE TO INFLATION, RECESSION, UNEMPLOYMENT OR JOB WORRIES

Here is the business that can see you through rising costs and tight money worries! You can do VIP Vinyl Repair as a part-time extra moneymaker, or a full-time business. You have no business overhead of shop or office. Take phone calls at home. Equipment fits into the businesslike attache case that comes with your kit.

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2021 Montrose Ave., Chicago, IL 60618

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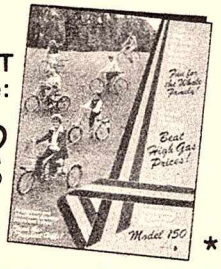

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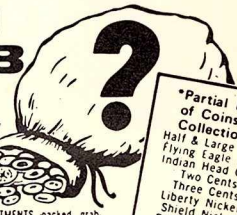

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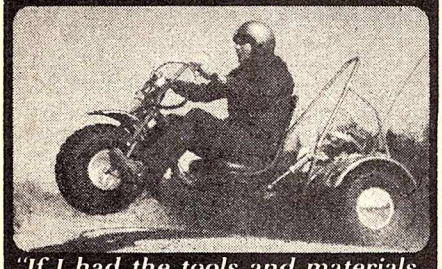
BUYING

3,000 alphabetically listed scrap items in our catalog. We pay over $750.00 per oz. for some scrap! The average price we pay for scrap is $12.45 per lb. . . 100's of millions of $ go unclaimed. Also included: instructions on where to find them, how to buy them cheap, how to identify them and how to ship. Double your money back with 1st shipment! Catalog refunded within 30 days for any reason. To get your catalog remit $7, plus $3 postage and handling, outside of U.S. add $5 postage and handling. Also included an item everyone throws away that is worth $5.00 per lb. . . **Poley's Industrial Salvage Co., Supply Dept. MI-2, 12389 Minges Rd., Battle Creek, MI 49017.**

Here's what one customer said:



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ONLY **$375** F.O.B.

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People who've looked everywhere tell us there isn't another spiral stair around that touches our combination of price and quality of materials and workmanship. We believe it!

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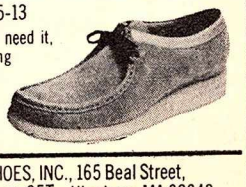

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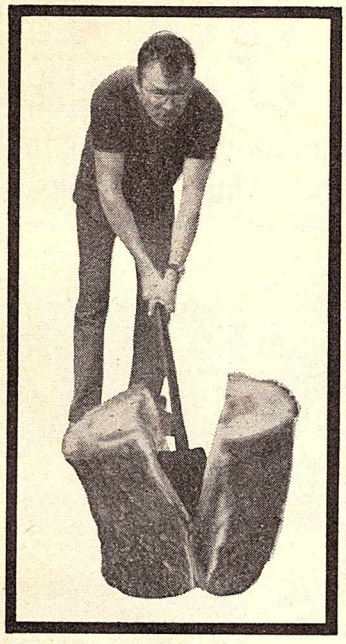

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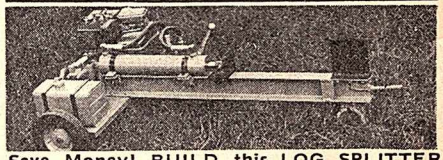

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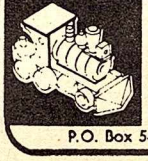

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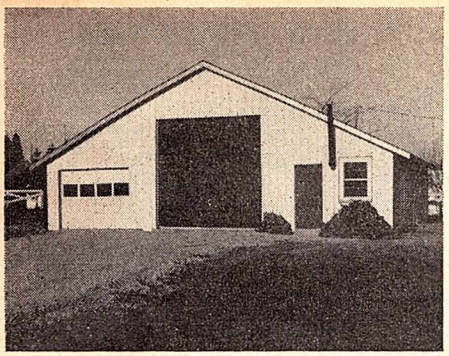

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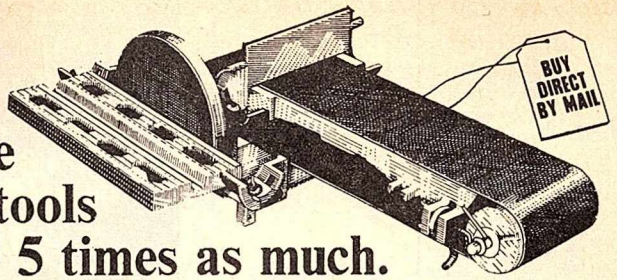

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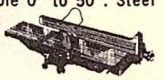

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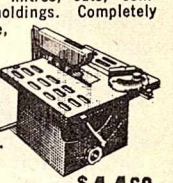

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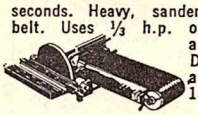

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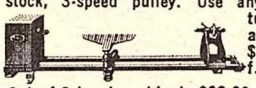

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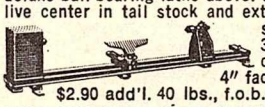

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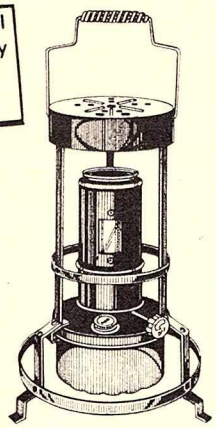

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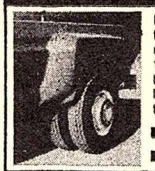

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Moneysworth, which tells how to get the most for your money and the most out of life, is read by an estimated 5,000,000. Its chief competitors are Consumer Reports, which sells for $12 a year, and Money magazine, for $14.95.

HOW TO ORDER

Readers of Mechanix Illustrated who wish to take advantage of this unparalleled offer should send their name and address with $2.97 to: Tenth Anniversary Special Subscriptions, Moneysworth, 1775 Broadway, New York, N.Y. 10019.

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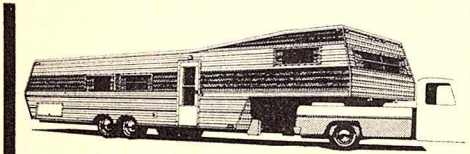

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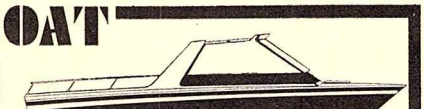

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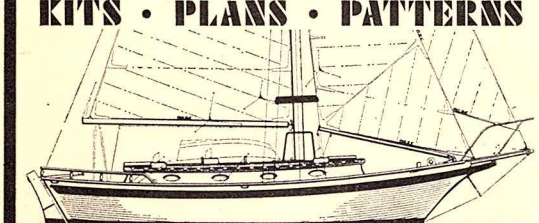

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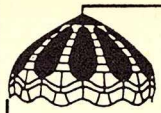

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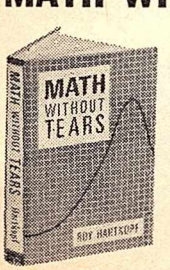

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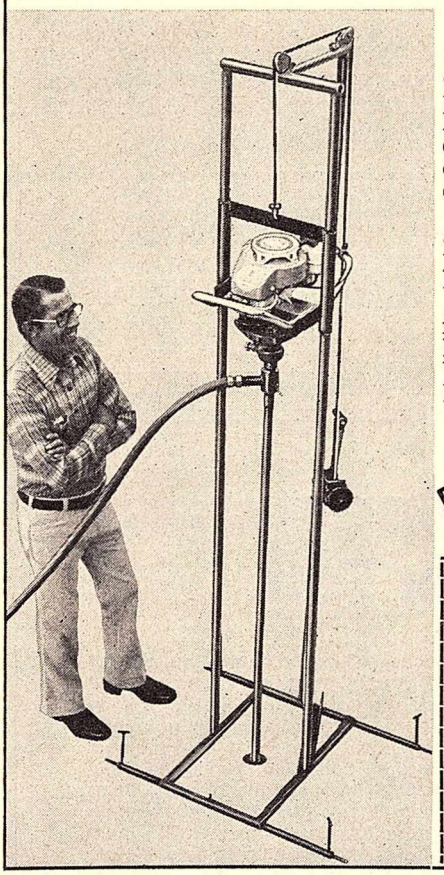

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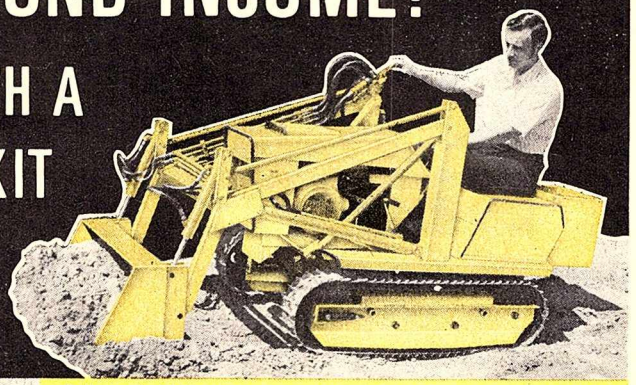

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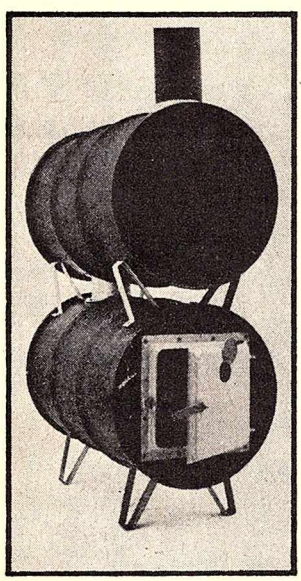

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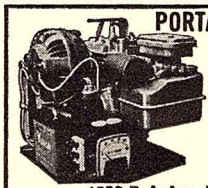

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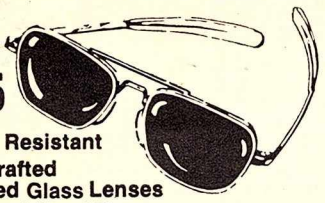

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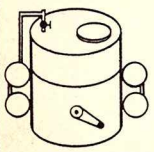

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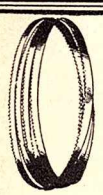

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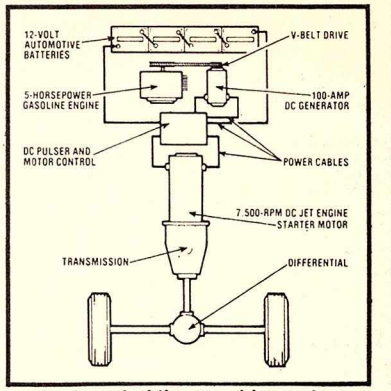

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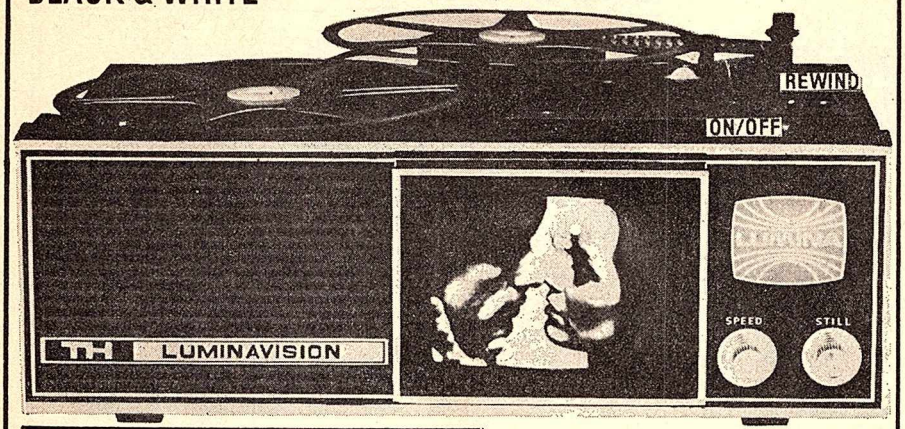

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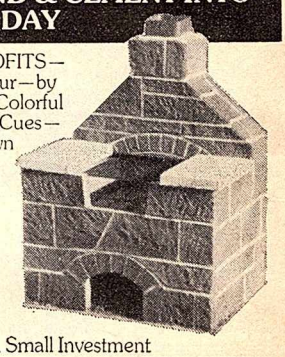

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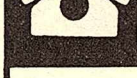

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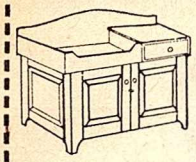

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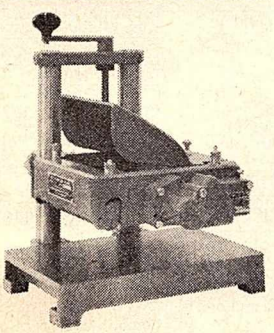

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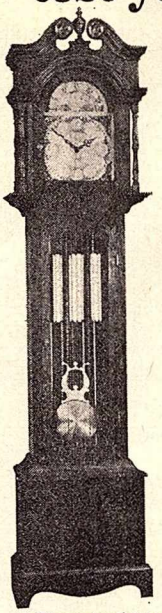

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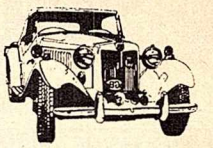

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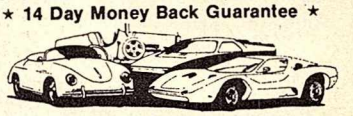

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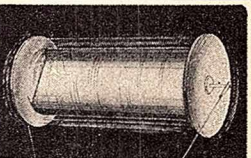

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Nuts!

By Bill Kilpatrick

The White House called the other day to ask our help in finding a scapegoat. It seems the President wants another four years' surcease from the peanut fields back home, and he needs a scapegoat to get him off the hook with the electorate regarding the energy mess.

We pointed out that scapegoats aren't what they used to be; that these days they tend to lack credibility, mainly because most of them look more and more like straw men rather than the genuine article. Our caller said the White House realized all that, but could we help out anyhow. We said we'd nose around and call back.

Our usually reliable scapegoat source is W.O. (Wise Old) Brown, a.k.a. Farmer Brown, owner and operator of a scapegoat ranch and fireworks stand out near the Interstate. He specializes in breeding and raising the Potomac, or political, variety of scapegoat. We personally haven't had need of a scapegoat in years so we hadn't called on Farmer Brown in some time.

When we drove up, we found him seated in a rocking chair on his front porch. He looked wise and old.

"W.O.," we said after shaking hands, "the White House needs a scapegoat to get the President off the hook regarding the energy mess."

"Yep," he replied, "dare say they do. Need more than one, too, if I'm any judge. But it won't do them any good. Besides, I can't help 'em."

Asked why he couldn't help, Farmer Brown explained that the Watergate mess had cleaned him out.

"In those days everybody and his uncle was looking for a scapegoat," he said, "and I just plain couldn't raise 'em fast enough. Why, when all of them were writing their books, they even took to breeding their own. Damn shame, too, because the poor critters didn't have a chance to become even the least bit believable. Thing like that hurts business.

"No," said W.O., a faraway look in his eyes, "I can't help you out. I've only got one left, and he's a little tyke the Missus and I keep around the place for our personal use. Helps keep a marriage going, you know."

We asked Farmer Brown if he knew where the White House might find a suitable scapegoat.

"Don't know of anyplace," he replied. "Not now, anyway. Fellow over on the Eastern Shore used to raise 'em, but the Bay of Pigs mess

wiped him out. But like I said, it won't do any good, even if the White House *does* find one. When it comes to energy, young fella, the people know who the real scapegoats are."

"The big oil companies, right?"

"No, not the big oil companies," W.O. shot back. "The big oil companies are doing just what they're chartered to do . . . rape and pillage so the rest of us can brag that it only took 47 minutes to drive 63 miles, a lot of it through traffic, too.

"Look, son," he said, a tolerant smile on his face, "to the bosses of big oil, those profits ain't obscene. Far from it. Hell, those profits are why they open the doors for business every morning. If you're going to go after the oil companies for making too much money, you might as well go after the great white shark for being too much of a shark. Both are supposed to *be* sharks; they're just doing what comes natural."

"Well, if it's not the big oil companies, it has to be the OPEC nations."

"OPEC don't have any real power," he said. "It's nothing more than a big punching bag, set up by the oil companies so the rest of us can have something to cuss at as we gas up the family car and pay the heating bill. Why, if all the Oklahoma, Texas and Louisiana accents within the borders of the foreign oil-producing nations were rounded up and shipped home, the U.S. unemployment rate would bounce up a couple of points and OPEC would collapse within a week."

"Okay," we ventured, "then it must be the auto manufacturers and all those gas guzzlers."

Farmer Brown looked at us with a wise and old expression and said no, it wasn't the auto manufacturers.

"Let me tell you something about the car business," he said, leaning forward and pointing a finger at us. "It works like show biz: Give the people what they want and what they'll pay for, and if you want to send a message, call Western Union.

"If you don't believe me," he added, looking at us intently, "how else do you explain Chuck Barris and the 1958 Oldsmobile?"

"Well, golly, W.O.," we said, "if it isn't the big oil companies, and it isn't the OPEC nations, and it isn't the auto manufacturers and their gas guzzlers, it surely must be the politicians, right?"

(Turn back to page 128)

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